GAS

FORMERLY WESTERN GAS

ENGINEERING • UTILIZATION • LOAD-BUILDING • MANAGEMENT

15314

Management finds:

ACCURACY HIGH

FIELD COST LOW

with EMCO ORIFICE METERS and the EMCO McGAUGHEY INTEGRATOR

The only known method of mechanically calculating orifice meter charts. Saves time and eliminates errors.

You can't afford to buy or sell gas unless it's accurately metered. This is especially true in large volume measurement, where the slightest inaccuracy can result in considerable loss of revenue. That's why we say, "Rely on EMCO Orifice Meters, they're inherently accurate."

EMCO Orifice Meter construction is based on the most advanced engineering principles. Sensitivity and strength are combined to the best advantage. Simplicity in design and accessibility of parts make field adjustment easy. The result—Accurate measurement at the lowest possible cost.

PITTSBURGH EQUITABLE METER CO.

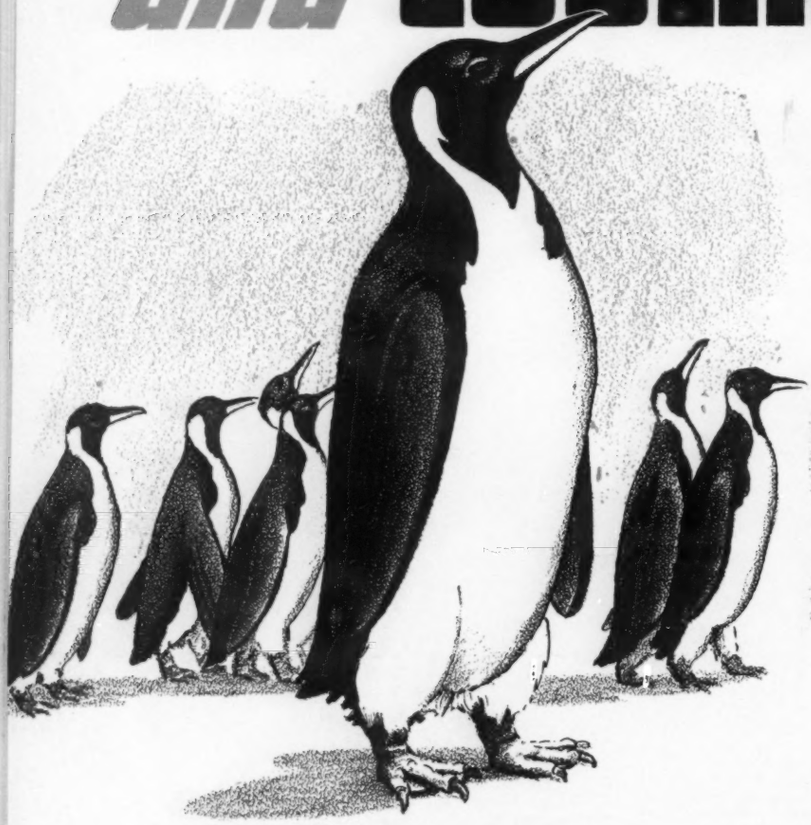
MERCO NORDSTROM VALVE CO.

MAIN OFFICES PITTSBURGH, PA.

NEW YORK · COLUMBIA · LOS ANGELES · KANSAS CITY · TULSA · CHICAGO · HOUSTON · PHILADELPHIA · MEMPHIS · ATLANTA · BUFFALO · OAKLAND

MARCH 1937 • • 25 CENTS

PENGUINS, PARROTS, *and* COOLING TOWERS



It makes very little difference whether you're up near the Arctic Circle or down on the Equator.

To Fluor, an unusual situation affords an ideal location. To Fluor, a cooling problem becomes a cooling job.

From Moose Jaw to Maracaibo, from Siberia to Siam, Fluor Aerator Type Cooling Towers cool water and save water. Placed within the Arctic's hoary hand, or within the Tropic's flaming maw, they yield the same continuous satisfaction, the same everlasting efficiency.

Fluor has designed its Aerator Type Cooling Tower to meet your conditions of place, altitude, temperature, wind velocity and volume. The unit pieces of each tower are accurately dimensioned; the assembled units are carefully crated and shipped; your engineer will have no difficulty supervising its erection.

Countless cases make it commonplace.

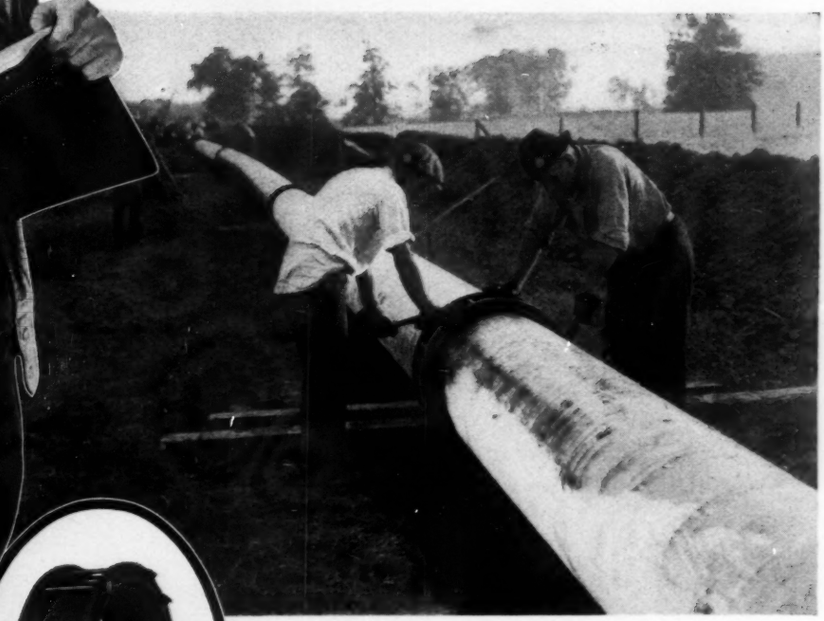
FLUOR BE SURE WITH FLUOR AERATOR TYPE COOLING TOWERS

Structurally, Fluor Aerator Type Cooling Towers are sturdy. California Redwood, the structural material, is selected because of its characteristic strength, stability and long life. The exclusive Aerator design is such that no straight line passage of air or water through the tower is possible. Pressure loss through Aerator is negligible with wind velocities under six miles per hour. With increased wind velocities, pressure drop increases, but the velocity across the cooling surfaces does not increase proportionately. Results: water distribution is undisturbed, spray is not carried through the tower, and cooling performance is uniform. A Bulletin, T236, is complete in its description.

THE FLUOR CORPORATION, LTD.

Main Office and Plant: 909 E. 59th St., Los Angeles, Calif. • 909 McCormick Bldg., Chicago, Ill. • 703 Fairfax Bldg., Kansas City, Mo. • 1402 Esperson Bldg., Houston, Texas • 710 Canadian Pacific Bldg., New York City, N.Y. • 30 Church St., New York City, N.Y. • 719 McBirney Bldg., Tulsa, Okla.

"TRUE EVERY TIME! I ALWAYS SEE ORDINARY LABOR ON A DRESSER-COUPLED LINE"



One of the most conspicuous features in the laying of a Dresser-coupled line is the absence of highly skilled labor. Reason: practically anyone can quickly assemble the "factory-made," fool-proof parts of the Dresser joint. Only one tool is required—a simple wrench to tighten the bolts. There's no need to bring in skilled labor from distant points. Ordinary labor—inexpensive and easy to get—does the trick. • So why gamble on the uncertainties of human nature? Use common labor and Dresser Couplings.

Note to Reader: This is the first in a series of advertisements based on one engineer's experience with his first Dresser-coupled line. For the complete story, write for Bulletin 351.

S. R. **DRESSER**
MFG. COMPANY • BRADFORD, PA.
In Canada: Dresser Mfg. Company, Ltd., 60 Front St., W., Toronto, Ont.

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GAS

FORMERLY WESTERN GAS

LOS ANGELES Office: 810 South Spring Street. Phone Michigan 1481
CHICAGO Office: 1064 Peoples Gas Building. Phone Harrison 8536

JAY JENKINS, Publisher — GEORGE H. FINLEY, Editor — CRAIG ESPY, Mid-Western Manager
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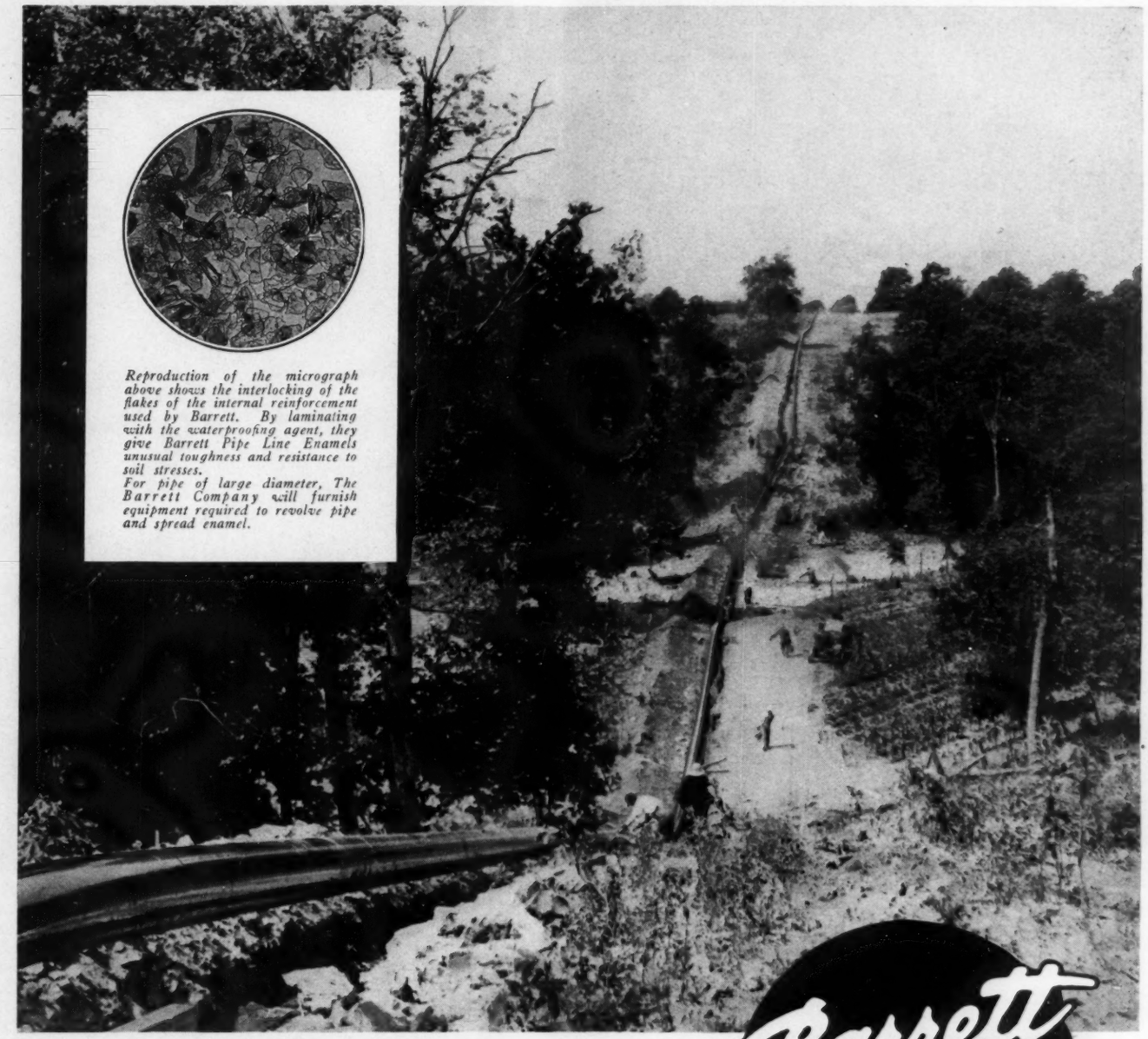
March, 1937. Volume XIII, Number 3, GAS is published monthly by Western Business Papers, Inc. at 810 South Spring Street, Los Angeles, California. Subscription price (in advance), 25 cents the copy. $2.00 per year; 2 years, $3.00; $3.00 per year foreign. Entered as second class matter August 20, 1936, at the post office at Los Angeles, Calif., under the Act of March 3, 1879. Copyright, 1937.

MEMBER AUDIT BUREAU OF CIRCULATIONS

OFFICIAL PUBLICATION: Pacific Coast Gas Association; Southern California Meter Association.

MEMBER: Audit Bureau of Circulations; Associated Business Papers, Inc.



Reproduction of the micrograph above shows the interlocking of the flakes of the internal reinforcement used by Barrett. By laminating with the waterproofing agent, they give Barrett Pipe Line Enamels unusual toughness and resistance to soil stresses.
For pipe of large diameter, The Barrett Company will furnish equipment required to revolve pipe and spread enamel.

Unusual resistance to soil stresses

THE unique flake-type filler employed in Barrett Pipe Line Enamels permits the use of greater quantities of high-melting-point coal-tar pitch base. The result is pipe coating with superior resistance to the destructive effects of soil action.

This feature, together with their high flowability and resistance to water absorption and line currents, makes Barrett Enamels an outstanding value for the protection of underground and underwater pipe line installations.

THE BARRETT COMPANY

40 Rector Street **New York, N. Y.**

Barrett

PIPE LINE ENAMELS

FIELD SERVICE

The Barrett Company maintains a Pipe Line Service Department to assist engineers in all coating problems, and also has available Field Service men whose assistance is offered where Barrett's protective coatings are used. Inquiries are invited.

"PARADE OF THE VALVES"

Big brutes of valves, little baby valves. Needle valves, globe valves, gate valves, pop valves. Brass, steel, iron and alloy valves. Valves for gas, air, oil, water, steam and chemicals. Any kind of valve—the biggest valve parade on earth!

Crane makes them—from a 40-cent "dwarf" to a 40-ton monster, Crane has the valve you want. You'll find them in the Crane No. 52 Catalog.

Maybe your valve problem seems special. Maybe you are wrestling with higher temperatures, greater pressures. Save time and cost by making use of Crane's 82 years of experience in valve making. You'll find the solution for most valve and piping problems in your Crane No. 52 and other Catalogs. They contain the details regarding over 38,000 items, tested in the laboratory and proved on the job. Use them whenever you need valves, fittings, pipe or accessories. CranEquip for satisfaction.

CRANE

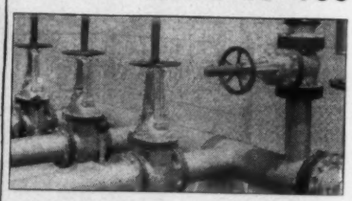
CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO, ILLINOIS

Branches and Sales Offices in One Hundred and Sixty Cities

VALVES, FITTINGS, FABRICATED PIPE, PUMPS, HEATING AND PLUMBING MATERIAL

plied in the next few days.

MYSTERIES TO THE LAYMAN: VITAL TO YOU



CHICAGO, ILL., Feb. 18—Talk to a gas consumer about headers for river crossings, meter manifolds "packing the line," compressors and gas holders—and you seldom find a flicker of comprehension unless you translate gas holder into "gas tank."

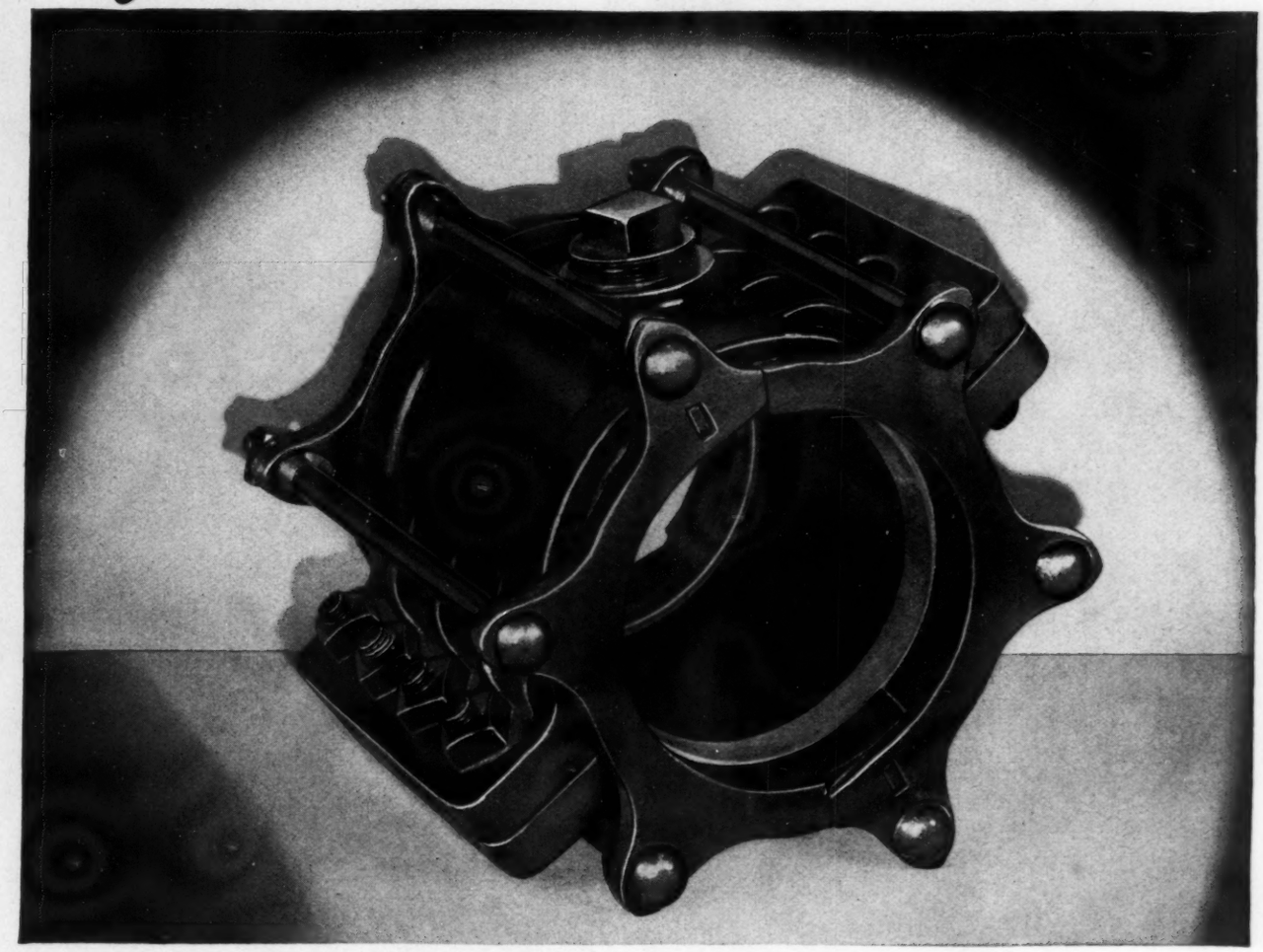
But to you, the above and other parts of a gas production and gas distribution system are vital, everyday, familiar things which may develop trouble any moment of the day or night. Yet the gas must go through.

Minimize your troubles, insure constant operation by CranEquipping everywhere. Crane valves, fittings and piping offer you complete lines of units that will stand wear and tear. Crane branches and distributors all over the map have adequate stocks to help you in emergencies. Use Crane as a single source to simplify your buying and you can rely on an adequate single responsibility for performance and service.

38,000 Items

There are 38,000 items listed in the big Crane No. 52 Catalog. You'll find in it types of valves that suit your needs. You will also find valves and fittings of different metals and alloys to check the types of corrosion and handle such pressures and temperatures as you may have. Use your Crane No. 52 Catalog—or bring your problems to us. All that we have learned from our 82 years of piping experience is at your command.

A new Split Sleeve for Cast Iron Mains

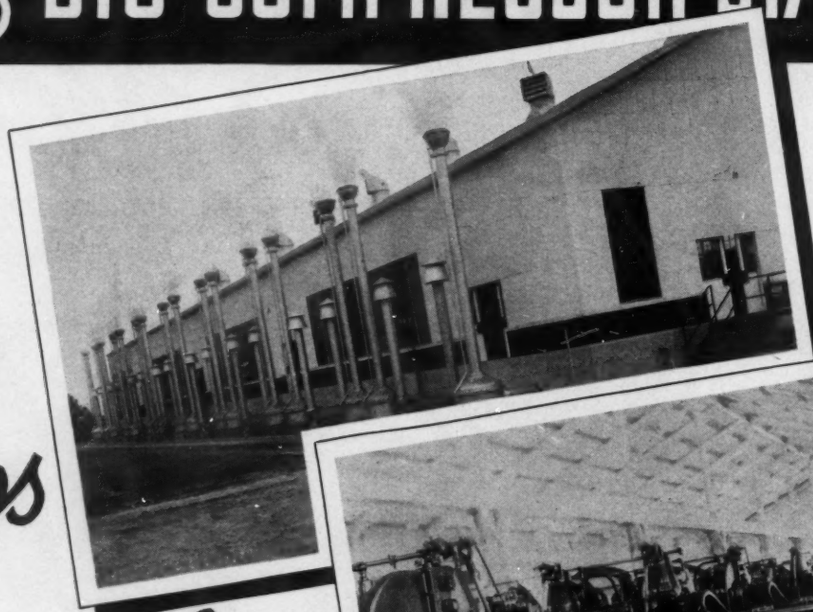


Dayton No. 8A

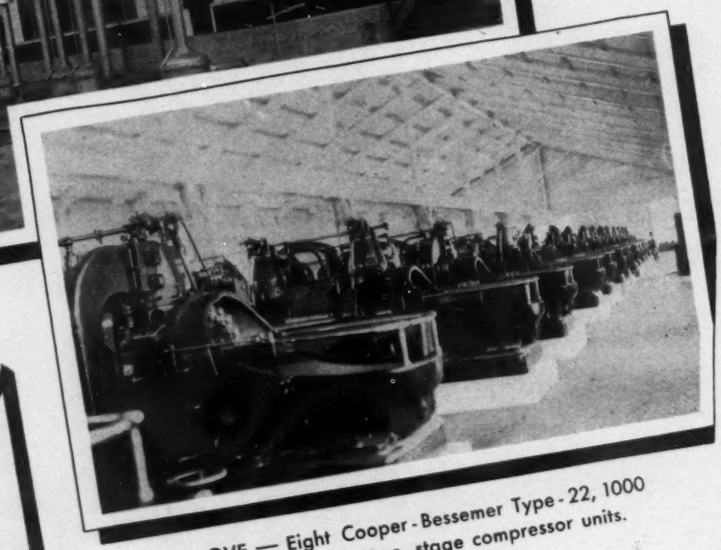
Longer center for complete coverage of irregular breaks. Center flanges of malleable iron permit lighter construction and contribute to ease of application. Built in 4 and 6 inch sizes. Other sizes on special order.

THE NATIONAL SUPPLY CO. OF DELAWARE
DAYTON COUPLING DIVISION · DAYTON · OHIO

This BIG COMPRESSOR STATION



LEFT—United Gas Public Service Company's Rodessa (La.) compressor station.



ABOVE — Eight Cooper-Bessemer Type-22, 1000 H. P., four-cycle, two-stage compressor units.

Whips 2 jobs WITH COOPER-BESSEMERS

GASOLINE EXTRACTION

GAS TRANSMISSION

This Rodessa Compressor Station is one of the largest and most modern in the South. Capable of handling 60,000,000 cu. ft. of gas daily, the station has a dual purpose:

(1) Compressing wet gas up to 450 lbs. pressure, and boosting it to the Myrtis Gasoline Plant.

(2) Forcing the gas through the gasoline plant, into the transmission system of United Gas Public Service Company, and forth to distant markets.

THE COOPER-BESSEMER CORPORATION

Mt Vernon, Ohio — PLANTS — Grove City, Pennsylvania

25 West 43rd Street, New York City — Mills Building, Washington, D. C. — 640 East 61st Street, Los Angeles, Calif. — 201 East 1st Street, Tulsa, Oklahoma — 631 Spring Street, Shreveport, La. — Magnolia Building, Dallas, Texas — Esperson Building, Houston, Texas

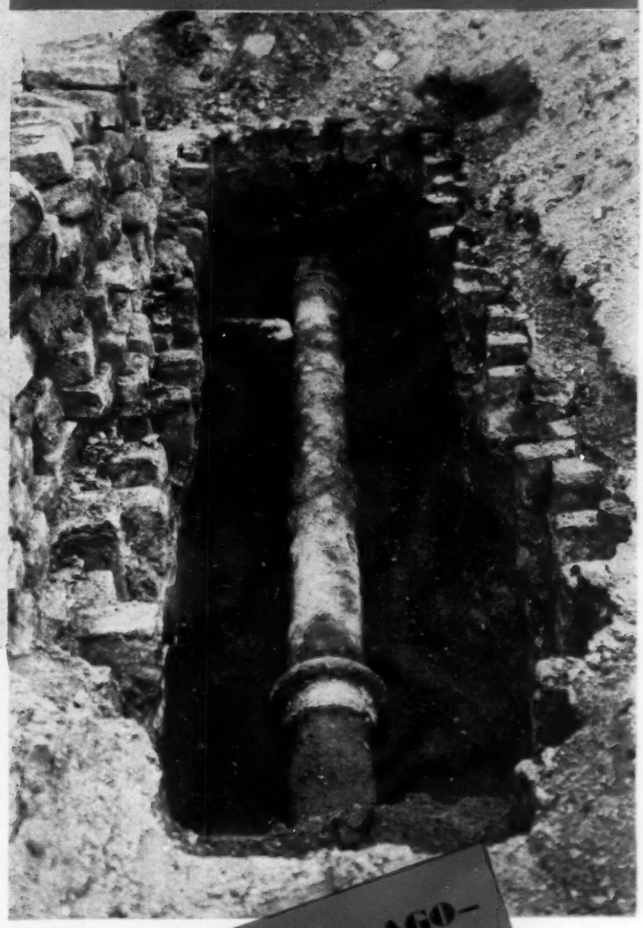
NOW...

Modern mechanical joints

TODAY—A recent installation of mechanical joint cast iron pipe for gas service.

AS THEN

but the same long-lived material



A CENTURY AGO—A cast iron gas main which has been in service in the City of Charleston, S. C., for a century.

For modern operating conditions in gas distribution service our members supply modern mechanical joint cast iron pipe that is known to be gas-tight. The records supply proof that cast iron pipe is unequalled for long life. Original cast iron gas mains are in service in 29 large cities. This combination of efficiency and economy is available in mechanical joint cast iron pipe in diameters from 1¼ to 84 in.

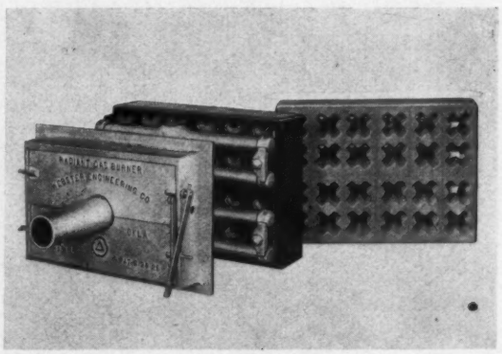
CAST IRON PIPE

THE STANDARD MATERIAL FOR UNDERGROUND MAINS

The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe
Research Engr., 1013 Peoples Gas Bldg., Chicago

The WEBSTER Formula
for Boiler Burner Installations

Proper Size + Proper Type Burner, Installed in the Right Place in the Right Way = High Efficiency and Satisfactory Operation.



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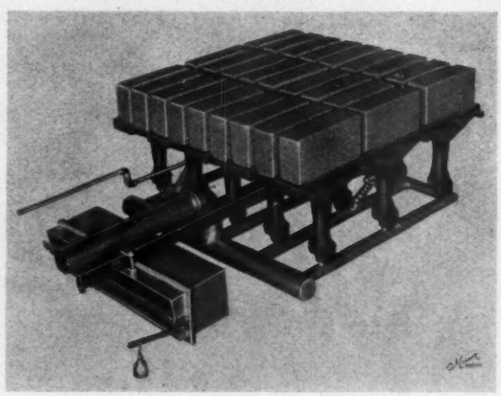
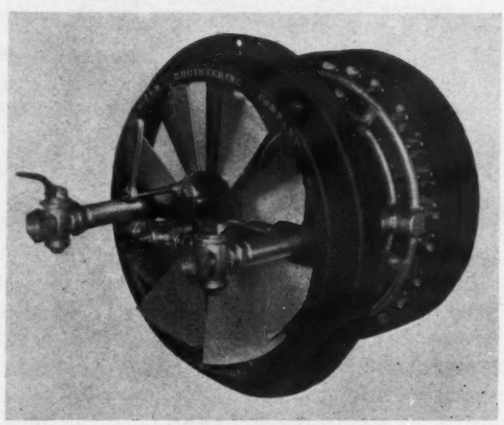
No Webster gas conversion installation is ever made without careful consideration being given to:

1. Type of equipment best suited for the boiler.
2. Type of equipment best suited for the service required.
3. Type of equipment best suited for the job from an economical standpoint.
4. Probable life of the equipment in this service.
5. Suitable controls.



There is a Webster Burner for every boiler—providing all the advantages of special equipment with standard methods and low installation cost.



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Our engineering department welcomes your boiler firing problems, and our recommendations are offered in return for your earnest consideration of the advantages of Webster Engineered Boiler Burners.

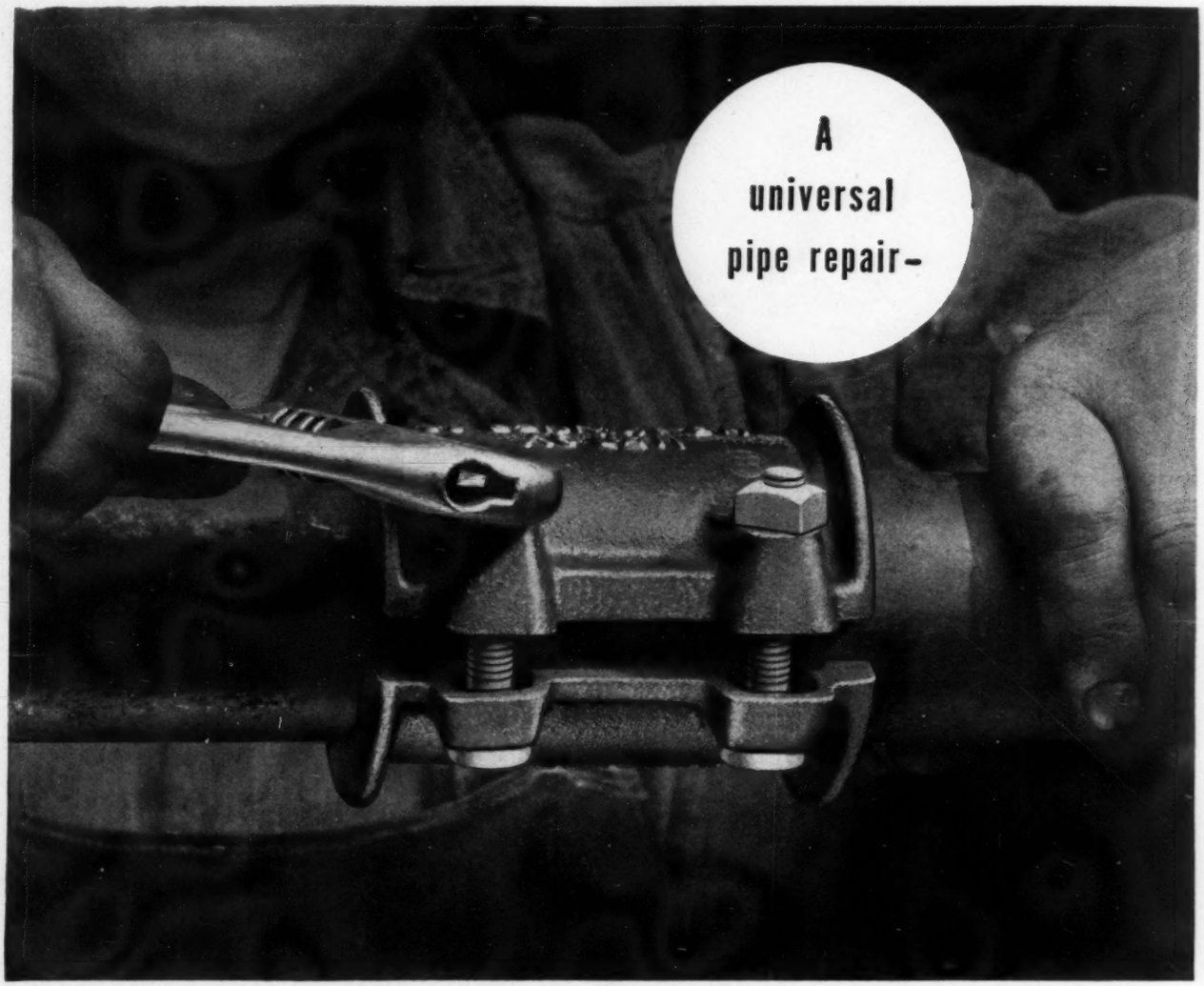
THE WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA

Division of

THE SURFACE COMBUSTION CORPORATION TOLEDO, OHIO

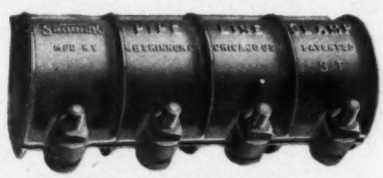
—— Pacific Coast Distributors ——

Natural Gas Equipment, Inc. — Los Angeles — San Francisco



EMERGENCY PIPE CLAMP

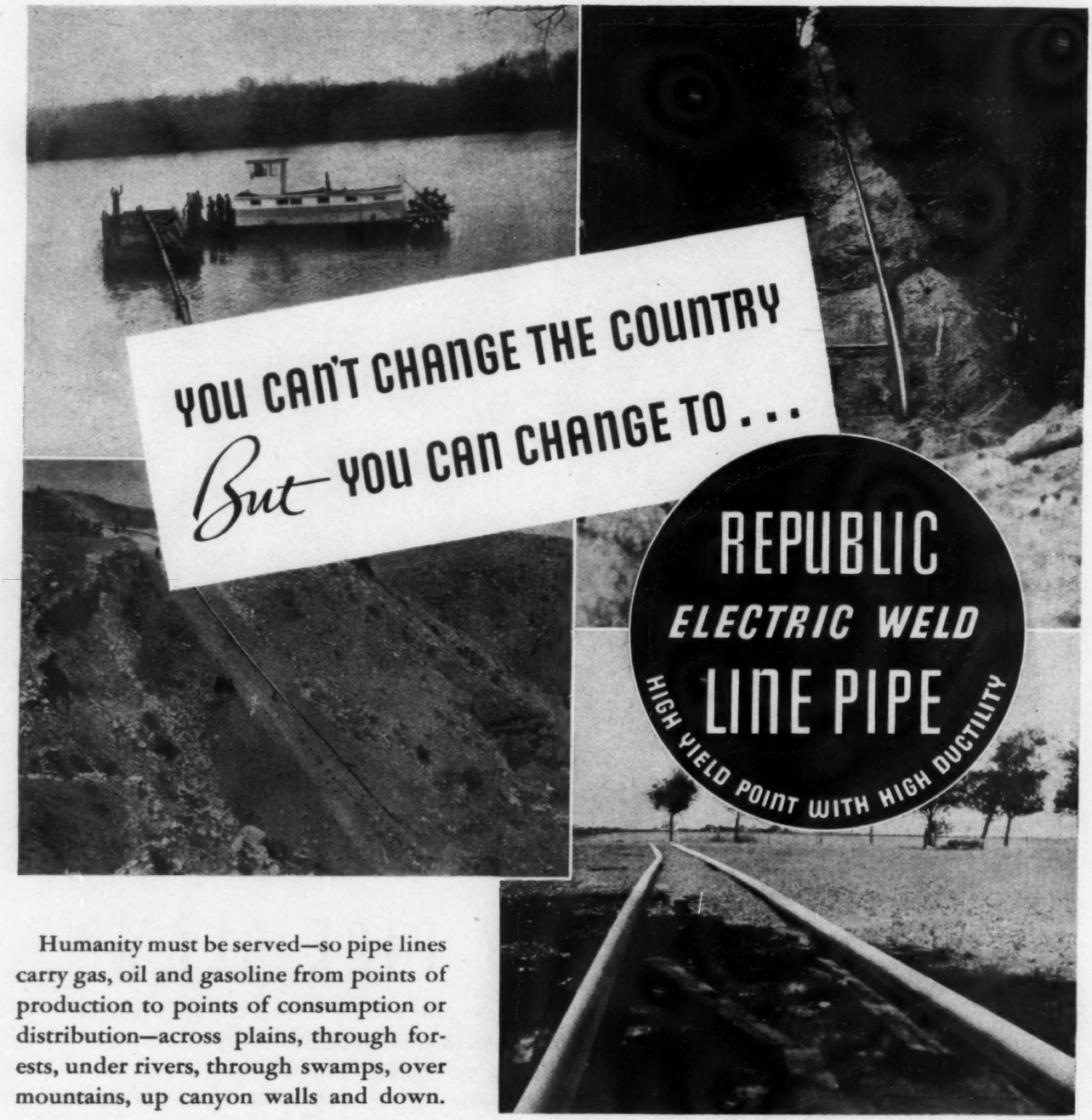
40 years of satisfactory use make this sturdy clamp the standard of the industry. For stopping leaks in pipe lines, instantly and permanently. Quickly, easily applied by anyone, with a small wrench . . . for steel or cast iron pipe sizes ½″ to 12″ . . . no pressure too high. Absolutely permanent. Saves cost of new pipe, extra labor, shutdowns.



Also available in double lengths for long splits or very bad corrosion. Listed as SKINNER PIPE LINE CLAMP. For pipe sizes ¾″ to 7″ O.D.

Made of malleable iron, enamelled to resist rust, and equipped with large cadmium plated steel bolts and rubber gasket. Note raised lugs for wrench convenience. Write for complete Skinner catalog.

M. B. SKINNER CO. *Est. 1898* SOUTH BEND, IND.



Humanity must be served—so pipe lines carry gas, oil and gasoline from points of production to points of consumption or distribution—across plains, through forests, under rivers, through swamps, over mountains, up canyon walls and down.

Oil and gas companies are in business to make money—so many of them use Republic Electric Weld Line Pipe in constructing their lines. More than 8,000 miles is now in service.

Republic Electric Weld Line Pipe saves time and construction and maintenance expense on long and short lines in all parts of the country—because it is perfectly round—uniform in wall thickness and diameter—easy to bend and weld in the field—unusually strong—free from scale—and because it is available in sizes up to 16″ O. D. and in lengths up to 50 feet without mid-weld.

Complete information will be sent upon request.

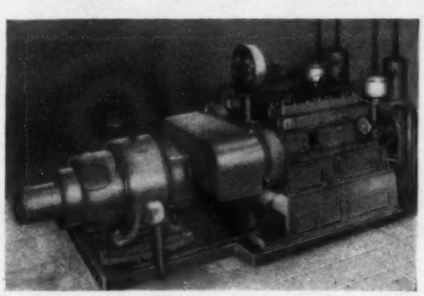
Republic Steel Corporation

GENERAL OFFICES . . . CLEVELAND, OHIO

REPUBLIC STEEL

"Every one of those types of business — and many more in your territory, are NOW prospective buyers of gas* to make their own light and power."

*LYCOMING Continuous Duty NATURAL GAS ENGINES



These Lycoming Engines replace purchased electric power, either by means of generation or direct application of the engine to the load. They are clean, quiet, vibrationless, and cool—and are engineered for 100,000 hours continuous duty. New, dual-engine-driven generating units eliminate stand-by necessity. Lycoming Natural Gas Engines and Gas Engine Generating-Units are built complete in one factory. *Write us for complete information.*

LYCOMING MANUFACTURING COMPANY

Home Office, Works and Foundries, WILLIAMSPORT, PENNSYLVANIA

QUALITY ENGINE BUILDERS FOR 30 YEARS

The Gas Service is only as modern as the gas range

The standard of top burner cooking performance depends entirely on the devices contained in the range.

The Universal with its advanced devices—Simmer-Save Burners, Thriftop and Thrift-Grates—presents an entirely new and higher standard of top burner cooking performance.

Universal Gas Ranges With New, Improved Simmer-Save Burner Make Possible a More Simplified, Certain, Healthful and Economical Top Burner Cooking Service

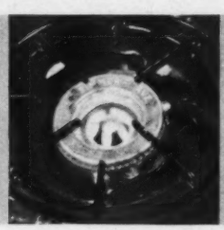
● Beauty and styling are important considerations. However, the average consumer judges the modernity and real merit of the gas range, as well as gas fuel itself, on performance—not on appearance. The consumer rightfully expects a definitely superior cooking performance from the new range as compared to the old stove which it replaced.

The standard of service rendered by the modern gas range should not only embrace improved mechanical operation, more efficient and economical utilization of gas, it should also present a higher standard of performance throughout the entire field of cookery—from start to finish. The Universal gives that type of performance—it not only introduces a more convenient, a more efficient and a greater time releasing service, but in addition, it simplifies all methods of cookery—it caters to the true interests of the Homemaker.

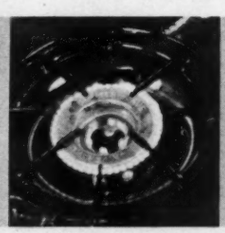
The Universal eliminates all the time-consuming and laborious tasks formerly associated with the actual cooking of foods. Pot watching—boil-overs—burned foods—excess heat, steam and humidity—all are discarded with the old stove when a Universal is installed in the kitchen. The Universal modernizes gas service.

Thriftop and Thrift-Grates—improve appearance of cooking top—increase efficiency—easy to clean.

True warming heat—gives efficient combustion on consumption of 1/2 to 1/3 cubic feet of gas per hour.



Controlled boiling heat—five ports keep water at boiling temperature with minimum evaporation.



Medium flame—ideal frying heat—burner with diameter of 3 inches gives even spread of heat.

Fast hot flame for fast cooking—raises water to boiling point in shortest space of time.

Universal Gas Ranges

MANUFACTURED BY CRIBBEN & SEXTON COMPANY, 700 N. SACRAMENTO BOULEVARD, CHICAGO, ILLINOIS

GAS
March, 1937

Guest Editorial

YOUTH... Chief Asset of Expanding Liquefied Petroleum Gas Service

By G. G. OBERFELL

Vice-President, Phillips Petroleum Company

PROBABLY the greatest asset which the liquefied petroleum gas industry has had is its youth. It began without any preconceived ideas of what could not be done. It didn't know that safe, simple and relatively foolproof utilization equipment couldn't be designed. So it designed it! It didn't know that gas appliance efficiencies couldn't be increased. So more efficient appliances were designed and built. It didn't know that you couldn't sell during a depression. The result was that, while sales in 1929 were only 9,930,964 gallons, they were 76,855,000 gallons in 1935, and probably 95,000,000 gallons during 1936! These accomplishments are good proof that the industry was not handicapped by a knowledge of things that could not be done, because "they had been tried before."

True, a young industry usually grows fast, but one of the reasons an industry slows down is because the individuals who direct it grow old in their thinking, due to becoming saturated with falacious ideas and being hampered by traditions of the industry. Seldom does any basic industry reach a stationary or saturation point because the desires or needs of its potential customers are filled. It slows down only because these customers desire or need some other industry's products more, which is another way of saying that the leaders of the decadent industry have failed to match adequately the prices, conveniences and style of competitive commodities or services.

LET'S keep young in our thinking—let's keep doing things that "can't be done." Don't let traditions transcend our trust in the true scientific approach to a new and better way of doing things. We are fortunate in being part of an industry which fills a basic need of the nation by furnishing gas energy and service for homes and industries where this city advantage was not previously available. Such a basic industry never dies if its brains don't atrophy. Let's keep young, and the future of the liquefied petroleum gas industry can be just as bright in 1950 as it is in 1937.

Easy to adjust

out in the field

LET'S SEE HOW EASY it is to adjust a Westcott Orifice Meter! The door of the dust-and-moisture-proof aluminum case merely is swung open . . . exposing pressure spring, clock, chart, and recording mechanism. Or, by speedily removing the low-pressure chamber cover of the forged-steel differential gage body, the entire interior is accessible . . . without loosening a single connection that affects accuracy. Adjustments do not interfere with any of the working parts . . . few in number and simple in design, despite their many features and refinements.

Comprehensive literature describes the expense-saving Westcott Orifice Meters and Flowmeters . . . clearly defines their applications. Specifications on the popular new Round Case Indicating Flowmeters also will be mailed on request.

AMERICAN METER CO. MEASUREMENT ENGINEERS CENTENNIAL 1836-1936

343

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Measurement and control of Gas, Oil, Steam, Air and Liquids
PACIFIC METER WORKS • LOS ANGELES • SAN FRANCISCO

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GAS

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LOS ANGELES—810 South Spring Street . . 1064 Peoples Gas Building—CHICAGO

EFFECT OF SELLING PRICE AND GAS RATE LEVEL UPON VOLUME OF GAS APPLIANCE SALES

By W. J. CROWLEY

and

C. H. BAILY

Public Service Company of Northern Illinois

IN May, 1936, an article on "Load Building on 100 Gas Systems" (by George H. Finley, Editor, *GAS*) was published in the columns of this magazine. To many sales managers of gas utility companies, this information presented a convenient means of checking the results of merchandising activities of the gas industry as a whole, and of sales promotional work of individual companies as well. To the writers it offered an opportunity for some intensive quantitative analysis on the subject of appliance sales and gas consumption as related to price of appliance and rate level. This brief article outlines the results of the work that has been done so far.

W. J. CROWLEY

The five factors which are most important in determining the volume of appliance sales and consumption of gas in any community are:

1. The price of service or rate level.
2. The selling price of the appliance.
3. The promotional effort.
4. The relative purchasing power of the people in the community.
5. The degree of saturation of the market for the appliance.

These factors are not listed in the order of their importance. As a matter of fact, their relative importance has not been definitely determined.

In a preliminary study of the effects of these factors, distinct tendencies were discovered which appeared strong enough to make worth while more intensive observation. As one example, a group of communities having about the same rate for automatic water-heating service was examined. A very close correlation was found between the degree of saturation of automatic gas water heaters and relative purchasing power of these towns. Unfortunately, the data in the article referred to above were not of such nature that analyses and comparisons based on purchasing power could be made. However, they did permit some very good comparisons on the basis of price of appliance and price of service.

In setting up the material for these analyses, the first step was the elimination of data that appeared to be incomplete or ambiguous. There remained the information for 77 companies, which, combined, serve approximately 60 per cent of the domestic gas customers in the United States. This information was analyzed and cross-classified in order to bring out the effect of price of appliance and rate for service. Table No. 1 shows the relationship of price of appliance and price of service to sales of automatic gas water heaters. Table No. 2 shows similar information for gas refrigerators.

Grouping the individual companies according to average price of appliance and disregarding price of gas service, we find that the relative number of water heaters sold decreases rapidly as price of water heater increases.

Reference Price of Water Heater (Automatic)	Price Range of Water Heaters in Each Group		Av. No. Automatic Water Heaters Sold per 100 Domestic Gas Customers
	From	To	
$40	$24	$45	3.58
50	46	55	3.00
60	56	65	2.72
70	66	75	1.38
80	76	125	1.08

Classifying the same companies according to price of gas used for water-heating service and disregarding selling price of the water heater, the following results were found:

Price of Gas Used for Water-Heating Service		Av. No. Automatic Water Heaters Sold per 100 Domestic Gas Customers
Above	Under	
$ .00	$1.00	3.44
1.00	2.00	3.28
2.00	3.00	3.29
3.00	4.00	2.97
4.00	5.00	1.67
5.00		.96

There is nothing particularly surprising in the fact that sales of automatic wa-

ter heaters decrease as the price of gas increases. Nor was this analysis made to add unnecessary proof to what is already known. What is needed is information to answer questions such as this: Given a community where relative purchasing power is known, how much can sales of water heaters be influenced by a decrease in rates? How much by a decrease in price of water heater?

Turning to Table No. 2, we find that the information regarding variation of sales of gas refrigerators with selling price is not exactly in line with results experienced in the case of automatic water heaters.

Reference Price of Gas Refrigerator	Price Range of Refrigerators in Each Group From	To	Av. No. Gas Refrigerators Sold per 100 Domestic Gas Customers
$150		$162	1.12
175	$163	187	1.00
200	188	212	.88
225	213	237	1.44
250	238 and up		1.66

Classifying again by price of gas and disregarding selling-price of the appliance, we find that the results for gas refrigerator sales parallel those for automatic gas water heater sales, i.e., a definite increase in sales takes place as price of service declines.

Price of Gas Used for Gas Refrigeration Service (Relative) Above	Under	Av. No. of Gas Refrigerators Sold per 100 Domestic Gas Customers
$ .00	$1.00	3.21
1.00	2.00	1.78
2.00	3.00	.78
3.00	4.00	.98
4.00	5.00	.74
5.00		.65

Even where the effect of one factor or the other is removed, the remaining factor controlled definitely the number of appliances sold per 100 customers. For example, in Table No. 1, it will be noted that, in each bill classification, the average number of water heaters sold per 100 customers declines as price of water heater increases. Again, in each water heater price group, the number of water heaters sold per 100 customers declines as water-heating bill increases. In some cases the decline is irregular but definite, the irregularities being due, beyond doubt, to small size of samples in certain groups, since it is difficult to secure average or normal distributions where samples of only three to six companies are used.

Certain irregularities are observed in the various groups in the cross-classification tables but they appear to be explainable. Here are two examples of the irregularities referred to:

1. Three companies of the 77 analyzed fell in the class that sold water heaters at $40 and had bills for water-heating service between $1.00 and $2.00 (See Table No. 1). Sales of automatic water heaters per 100 domestic gas customers of these three companies were:

Company 1	8.65
Company 2	6.00
Company 3	1.42

2. Seven of the companies sold water heaters at $60, with bills for automatic gas water-heating service between $4.00 and $5.00. Their sales of water heaters per 100 domestic gas customers were as follows:

Company 1	3.06
Company 2	2.64
Company 3	2.14
Company 4	1.82
Company 5	1.66
Company 6	1.07
Company 7	.47

It should be noted that the data for the original 77 companies have been analyzed so far only with respect to price of appliance and price of gas. It has not been possible to analyze the sales of these companies with respect to relative purchasing power of the customers or on the basis of promotional effort behind the sales of automatic gas water heaters and gas refrigerators during the year 1935. It is apparent that among 77 gas companies representing half of the domestic gas business in the United States, relative purchasing power is going to vary considerably depending upon the type of territory served. In addition to variations in relative purchasing power, there will be other variations depending upon the intensity of sales promotional operations. Many companies campaigned automatic gas water heaters intensively in 1935; many others campaigned moderately; the remainder, very little.

A word of warning will not be out of place at this point. The relationships exhibited in Tables No. 1 and 2 should not be accepted at their face value. The impression might be gained upon a superficial examination of the evidence presented here, that rates and appliance prices should be reduced if appliance sales are to be stimulated. But the two other important factors have not yet been taken into consideration, and until they have been, the results set out above should be studied with interest, but not used as conclusive proof of the effects of reductions in rates and appliance prices on sales of automatic water heaters and refrigerators.

In order to carry the foregoing analysis beyond this point, more information is required. First of all, the relative purchasing power of the territory served must be found. This is a relatively easy task, for relative purchasing power can be determined from information fairly easy to obtain. Some of the bases that can be used for this purpose are:

1. Average consumption of gas and electricity per residential customer.
2. Number of residential telephones per 100 population.
3. Number of automobiles per 100 population.
4. Average value of home.
5. Income data.

In addition to the information on rela-

Calendar

March

American Society for Testing Materials—1937 Regional Meeting and Committee Week, Palmer House, Chicago, March 1-5.

American Gas Association, Industrial Gas Section—General Commercial and Hotel and Restaurant Sales Conference, Philadelphia, Pa., March 2-3.

Southern Gas Association—Southwest Regional Gas Sales Conference, Peabody Hotel, Memphis, Tenn., March 10-12.

Wisconsin Utilities Association, Gas Section: Commercial and Technical Divisions—Joint convention and manufacturers exhibit, Schroeder Hotel, Milwaukee, Wis., March 15-17.

Pacific Coast Gas Association—Technical Section Regional Conference, Auditorium of the Los Angeles Gas & Electric Corp., Los Angeles, Calif., March 18-19.

New Jersey Gas Association—26th annual meeting, Berkley Carteret Hotel, Asbury Park, N. J., March 23.

April

Pacific Coast Gas Association—Sales and Advertising Section Spring Sales Conference, Auditorium of the Los Angeles Gas & Electric Corp., Los Angeles, Calif., April 1-2.

National Bottled Gas Association, Midwest Section—Cedar Rapids, Iowa, April 2.

American Gas Association, Distribution Conference—Washington, D. C., April 12-14.

Mid-West Gas Association—32nd annual convention, Waterloo, Iowa, April 12-14.

Missouri Association of Public Utilities—Elms Hotel, Excelsior Springs, Mo., April 21-23.

Indiana Gas Association — Hotel Roberts, Muncie, Ind., April 28-29.

May

Pennsylvania Gas Association — Sky Top Lodge, Sky Top, Pa., May 4-6.

American Gas Association, Natural Gas Department—Civic Auditorium, Kansas City, Mo., May 10-15.

American Gas Association, Production and Chemical Conference—New York City, N. Y., May 24-26.

June

American Gas Association, Industrial Gas Section — Industrial Gas Sales Conference, Chicago, Ill., June 8-9.

Canadian Gas Association — 30th Annual Convention, Chateau Laurier Hotel, Ottawa, Canada, June 10-11.

American Society of Heating and Ventilation Engineers — New Ocean House, Swampscott, Mass., June 24-26.

July

Michigan Gas Association — Grand Hotel, Mackinac Island, Mich., July 1-3.

October

American Gas Association—October 11-16.

American Society for Metals—1937 Metal Congress and Exposition, Atlantic City Auditorium, Atlantic City, N. J., October 18-21.

TABLE NO. 1. CROSS CLASSIFICATION SHOWING RELATIONSHIP OF PRICE AND RATE TO SALES OF AUTOMATIC GAS WATER HEATERS

Price	Average Sold Per 100 Customers	Bill Under $1.00		Bill $1.00-$2.00		Bill $2.00-$3.00		Bill $3.00-$4.00		Bill $4.00-$5.00		Bill Over $5.00		Average Bill in Each Group
		(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	
$40		$0.90	6.48	$1.57	6.00	$2.40	2.34	$3.90	5.65	$4.06	2.20	$5.53	.21	
				1.63	8.65	2.70	4.65			4.30	1.86	5.53	.19	
				1.95	1.42							5.07	3.28	
	3.58	$0.90	6.48	$1.72	5.36	$2.55	3.50	$3.90	5.65	$4.18	2.03	$5.38	1.23	$3.30
$50		$0.00	2.49	$1.38	1.96	$2.71	5.62	$3.57	5.83	$4.06	2.06	$5.18	.29	
		.88	1.36	1.57	3.29	2.10	4.73	3.15	5.50	4.22	5.15	5.54	2.04	
				1.58	5.43	2.84	.63	3.13	2.42	4.35	.93			
				1.69	1.04	2.02	3.96							
				1.68	4.20	2.27	1.18							
				1.87	5.16	2.91	.40							
				1.68	4.06									
				1.63	2.22									
				1.69	3.04									
	3.00	$0.44	1.93	$1.64	3.38	$2.48	2.75	$3.28	4.58	$4.21	2.71	$5.36	1.17	$2.55
$60				$1.67	4.68	$2.20	4.15	$3.60	5.84	$4.21	1.82	$5.05	.68	
				1.05	1.34	2.20	7.74	3.60	.62	4.76	3.06			
				1.82	1.91	2.44	3.62	3.33	4.00	4.10	2.64			
				1.52	1.48					4.20	1.07			
										4.27	2.14			
										4.65	1.66			
										4.18	.47			
	2.72			$1.52	2.35	$2.28	5.17	$3.51	3.49	$4.34	1.84	$5.05	.68	$3.27
$70				$1.07	2.24	$2.34	2.70	$3.70	.85	$4.78	.52	$6.31	1.32	
						2.95	1.02	3.88	1.42	4.10	3.30	5.19	1.29	
								3.15	1.44	4.89	.17			
										4.01	.27			
	1.38			$1.07	2.24	$2.65	1.86	$3.58	1.24	$4.45	1.07	$5.75	1.31	$3.86
$80				$1.36	.88			$3.97	1.23	$4.09	.34	$5.44	.57	
								3.88	3.91	4.94	.36	5.36	.11	
								3.49	.14			5.40	.55	
								3.53	2.70					
	1.08			$1.36	.88			$3.72	2.00	$4.52	.35	$5.40	.41	$4.15
	Average Bill Each Group	$0.59		$1.58		$2.47		$3.56		$4.34		$5.42		Averages Entire Group $3.25
	Average Sold Per 100 Customers		3.44		3.28		3.29		2.97		1.67		.96	2.52

(a) Price of gas used for water-heating service—the excess of a bill for 35 therms under the water-heating rate over a bill for 10 therms under the regular rate.

(b) Number of water heaters sold per 100 domestic customers.

NOTE: All data on average sales, above, are based on appliance sales for one year only, the year 1935.

tive purchasing power, the degree of promotional effort behind the sale of appliances must be determined. Very few companies are prepared to furnish quantitative information on that subject. For example, how many gas companies keep separate records showing for each major appliance the amount of selling and other promotional expense involved per year, per appliance sold, and per customer served? Yet just that information will be required if relative promotional effort is ever to be measured. As a conjecture, relative promotional expense for a given territory might be expressed in dollars expended per customer in that territory, where "dollars expended" is the sum of selling expense, demonstration and educational expense, and advertising expense, *for each appliance*. Many of the methods that have been used in cost allocation problems connected with rate making could be adopted with profit in allocation of sales promotional expenses, and beyond a doubt the information secured would be invaluable to sales executives.

One more factor, one not listed above, requires some attention in connection with this subject; namely, the effect of the business cycle. In depression periods there is, first, a decline in average purchasing power, and second, a psychological reaction which restrains people with means from spending money.

TABLE NO. 2. CROSS CLASSIFICATION SHOWING RELATIONSHIP OF PRICE AND RATE TO SALES OF GAS REFRIGERATORS

Price	Average Sold Per 100 Customers	Bill Under $1.00		Bill $1.00-$2.00		Bill $2.00-$3.00		Bill $3.00-$4.00		Bill $4.00-$5.00		Bill Over $5.00		Average Bill in Each Group
		(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	
		$0.00	2.70	$1.82	.22			$3.60	1.48	$4.27	.36	$5.44	1.08	
								3.33	.77	4.06	.63	5.18	.72	
								3.15	1.95	4.20	1.06			
$150								3.97	.89	4.22	.44			
										4.76	1.60			
	1.07		2.70	$1.82	.22			$3.51	1.27	$4.30	.82	$5.31	.90	$3.69
		$0.90	3.92			$2.84	1.02	$3.49	1.27	$4.89	1.39	$5.36	1.14	
						2.95	.86	3.15	.23	4.01	.63	5.53	.06	
								3.90	.79	4.30	2.02	5.40	.42	
$175								3.88	.33	4.18	.87	5.53	1.37	
								3.53	1.23	4.35	.25			
										4.09	.15			
	1.00	$0.90	3.92			$2.90	.94	$3.59	.77	$4.30	.89	$5.46	.75	$4.02
				$1.67	.29	$2.20	2.28	$3.57	1.16	$4.94	.17	$5.07	.23	
				1.95	.76			3.60	.74	4.10	1.75			
				1.38	1.50			3.70	1.76	4.06	.31			
$200										4.78	.27			
										4.10	.90			
										4.65	.13			
	.88			$1.67	.85	$2.20	2.28	$3.62	1.22	$4.44	.59	$5.07	.23	$3.56
				$1.68	.91	$2.10	.62	$3.88	.91			$6.31	1.30	
				1.36	1.01	2.91	1.05					5.05	.07	
				1.68	1.87	2.20	.28					5.19	.35	
				1.05	3.61	2.34	.82					5.54	.38	
$225				1.58	4.05	2.70	.11							
				1.69	.76	2.27	.60							
				1.87	2.19	2.40	.74							
	1.14			$1.56	2.06	$2.42	.60	$3.88	.91			$5.27	.53	$2.83
		$0.88	3.01	$1.57	.89	$2.44	.19	$3.13	.24	$4.21	.35			
				1.63	5.46									
$250				1.63	1.61									
				1.07	1.52									
	1.66	$0.88	3.01	$1.48	2.37	$2.44	.19	$3.13	.24	$4.21	.35			$2.07
	Average Bill Each Group	$0.59		$1.58		$2.49		$3.56		$4.34		$5.42		Averages Entire Group $3.34
	Average Sold Per 100 Customers		3.21		1.78		.78		.98		.74		.65	1.10

(a) Price of gas used for water-heating service—the excess of a bill for 35 therms under the water-heating rate over a bill for 10 therms under the regular rate. (The price of gas for water-heating service was used in this instance because this amount, as used, is merely an index of the "follow-on" price for any additional service over and above gas for cooking and minimum water-heating purposes.)

(b) Number of gas refrigerators sold per 100 domestic customers.

NOTE: All data on average sales, above, are based on appliance sales for one year only, the year 1935.

This means, simply, increased sales resistance. It appears, then, that any results gleaned from study of the group of factors listed in this article should be subject to some adjustment depending upon the phase of the business cycle.

It is too early to forecast the results of the analyses that will be made possible if complete factual data regarding merchandising activities of a large number of utility companies can be made available. However, as indicated above, in many cases such information will not be available until it is required by the individual companies. This will mean, in many instances, revision of the existing methods of accounting for merchandising and promotional expenses. These changes are going to be required sooner or later at any rate, for it should be apparent to anyone interested in the future of the gas industry, that the trend of domestic gas sales since 1930 and the growing pressure due to increasing expenses and decreasing rates leave no room for doubt that higher and higher merchandising efficiencies will most certainly be required by the gas industry.

GAS CAMERA

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GAS Camera welcomes photographs of gas industry personalities at work and at play. Pictures should be clear, and poses, informal.

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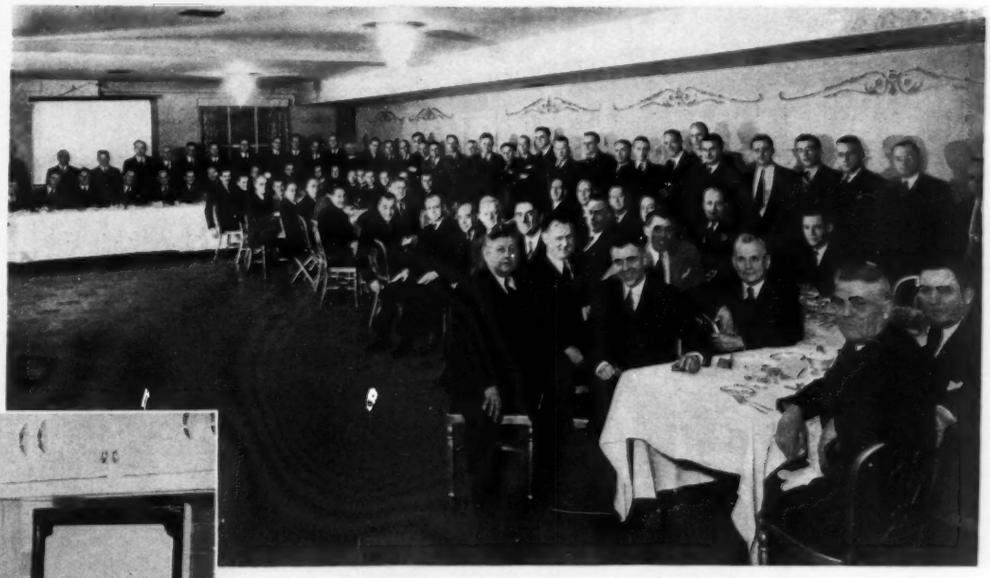
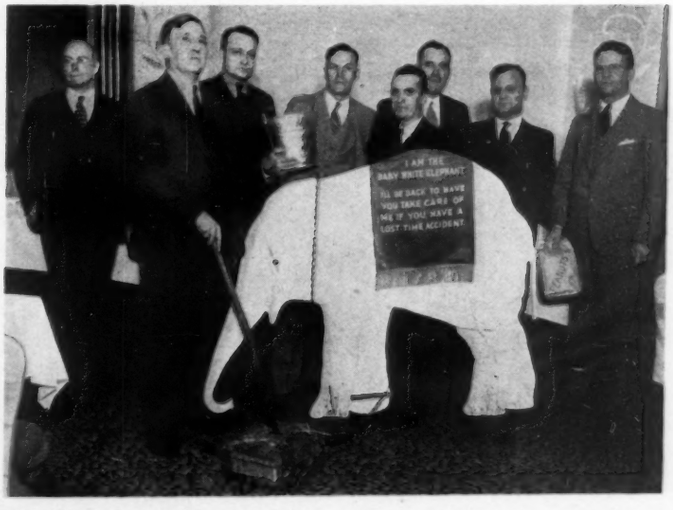
PANELLED IN veneer, stripped with ebony, appointed with gas displays is the modernistic and spacious principal showroom of the Colonial Gas Association, Ltd., which serves the city of Melbourne in Australia.



ENGINEERS ENTERTAINED: Midwest utility engineers gathered at a recent Chicago banquet as guests of the Condensation Engineering Corp. Andrew I. Andrews, University of Illinois; S. D. Whitman, Sioux Falls Gas Co.; and B. A. Johnson, Peoples Gas Light and Coke Co. spoke.

MODERN AND MAIDLESS: Elizabeth Lynahan (below) of the home service staff of Peoples Gas Light and Coke Co., Chicago, uses the Sunshine Kitchen in the company's main display room to demonstrate the preparation of a maidless company dinner.



BELONGING TO Wisconsin Public Service Corp.'s "Royal Order of the White Elephant" (right) is an unenviable distinction, as the beast symbolizes lost-time accidents. Inspecting the elephant, left to right, are company executives C. R. Phenicie, vice-president; J. P. Pulliam, president; M. H. Montross and A. J. Goedjen, division managers; C. B. Boulet, safety director; E. S. Schrank and A. F. Davey, division managers; and H. P. Taylor, ass't. secretary.

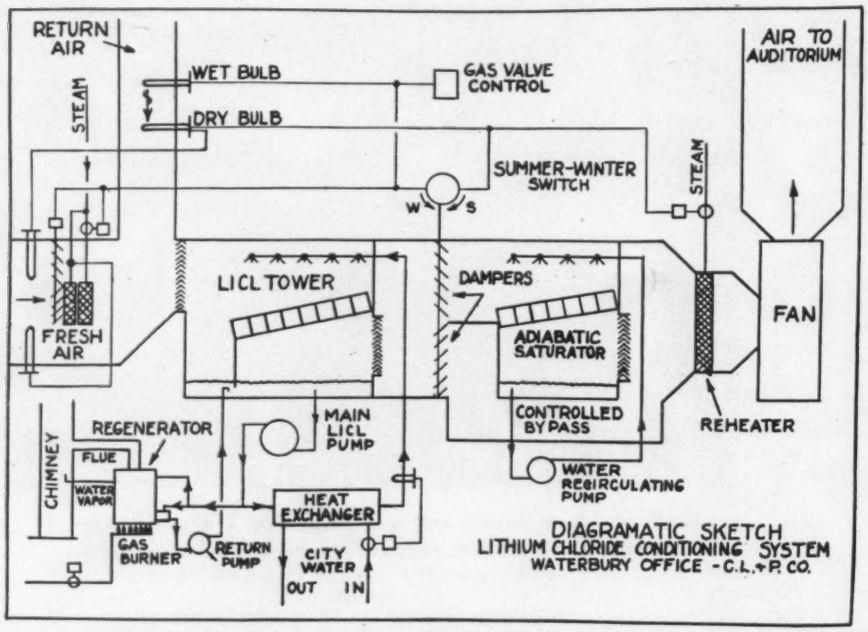


FIG. 1. Diagramatic sketch of a lithium chloride conditioning system

Air Conditioning With a Lithium Chloride System

● **S. R. KNAPP, Connecticut Light and Power Co., Hartford, Conn., in a paper entitled, "Air Conditioning with the Kathabar," presented before the Industrial Division, New England Gas Association, Boston, Mass., November, 1936.—(Abstract by G A S).**

THE system to be described is used to condition an auditorium located in an office building which, itself, is completely air conditioned. The auditorium is conditioned separately from the main building because it is used for relatively short periods and also because of the widely different load characteristics involved. In the case of the main system, the latent heat or moisture load constitutes only about 15 per cent of the total; whereas, this load in the auditorium may be as high as 50 per cent to 60 per cent of the total under certain conditions. This situation makes the adsorption system ideally suited to the job. Basic data follows:

Cubic Contents	24,000 cu.ft.
Maximum seating capacity	300
Total Air Circulated	7,500 c.f.m.
Outside Air	3,000 c.f.m.
Maximum Sensible Heat Load	143,000 B.t.u./hr.
Maximum Latent Heat Load	141,000 B.t.u./hr.
Max. Simultaneous Load	260,000 B.t.u./hr.
Max. Rate Moisture Removal (Approx.)	17 Gallons/hr.
Avg. Maximum Gas Load	400 cu.ft./hr. (530 B.t.u.)
Cooling Water (10° Rise)	75 G. P. M.

Referring to Fig. 1, the operation during the summer or cooling season is as follows: The recirculated air and the outside air mix at the entrance to the LICL dehumidifying tower. The mixed air enters the tower and passes through baskets containing fine strands of spun glass where it comes in intimate contact with the LICL which is sprayed from the nozzles above the baskets. As a result of the contact with the lithium chloride, the moisture content of the air is materially lowered and the latent heat given off, due to the condensation of moisture, is carried off by the lithium chloride. The air leaves the tower with its wet-bulb temperature at the condition desired for introduction into the conditioned space but with a relatively high dry-bulb temperature and a low dew point. In order to adjust the dry-bulb temperature to that required for the removal of the internal sensible heat load, a portion of the air, the exact amount being determined by automatic control, is passed through the adiabatic saturator. This does not change the total heat of the air but saturates it at the entering wet-bulb temperature. This saturated air is then mixed with the by-passed air to give the required conditions for introduction into the conditioned space.

The dry-bulb thermostat in the return air-duct controls the face and by-pass dampers at the entrance to the adiabatic saturator so as to maintain the proper inside temperature. The setting of this thermostat is automatically raised or lowered with the outside temperature by means of a master thermostat located in the fresh-air intake. The purpose of this adjustment is to avoid too much of a temperature reduction from the outside conditions.

The relative humidity is controlled by the wet-bulb thermostat in the return air which turns on and off the gas valves on the lithium chloride regenerator, thereby controlling its density. Since the ability of lithium chloride to absorb moisture is a function of the density of the solution, the control of this density provides a means of governing the rate of moisture removal from the air.

The spun-glass baskets in both the lithium chloride tower and the adiabatic saturator act as very efficient cleansers of the air, thereby making the use of the conventional, viscous-type filter unnecessary. In addition, the lithium chloride apparently has the property of absorbing odors to a far greater extent than any other means employed at the present time. There is no question but that the air which has been in contact with the lithium chloride gives a very pronounced feeling of freshness to the atmosphere in the conditioned space.

The lithium chloride, after passing through the baskets, is picked up from the sump by the main LICL pump, forcing about 90 per cent of the total flow through a series of heat interchangers where it is cooled by city water. The temperature of the LICL leaving the interchangers is held constant by a modulating valve in the city water supply line. The other 10 per cent of the flow is sent to the regenerator where it is boiled at a temperature of about 300° F. and the moisture is driven off in the form of steam which discharges to the chimney after passing through an economizer used for heating the incoming LICL. This economizer is not shown in the sketch.

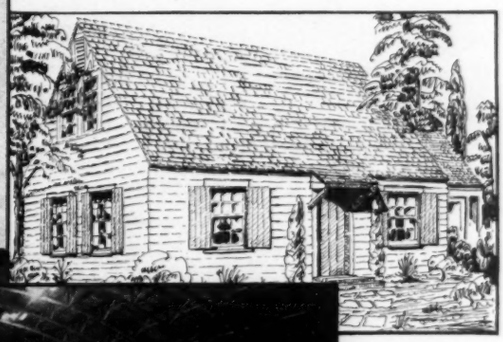
There is also another heat interchanger which is not shown that is used to cool the LICL returned from the regenerator. Both of these devices are refinements to improve the efficiency and are not essential to the system. On leaving the boiler, the LICL has a specific gravity sufficiently high so that, if it were allowed to cool without dilution, it would solidify in the pipes. In order to prevent this, some of the incoming LICL is mixed with the LICL leaving the boiler. The mixture is then picked up by the return pump and sent back to the sump in the lithium chloride tower.

In addition to the wet-bulb control of the gas burners, there are various other controls to insure safe operation, such

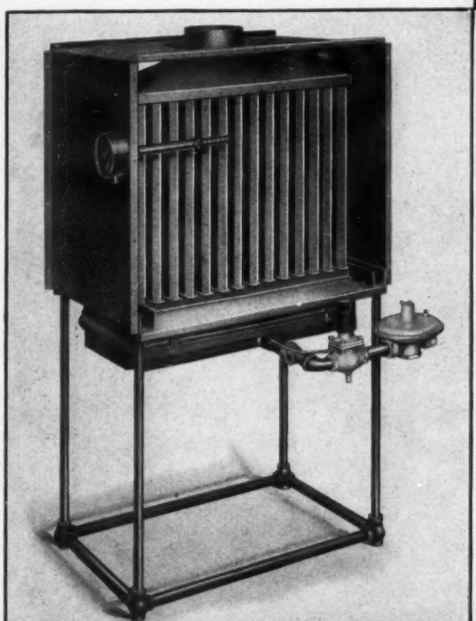
(Turn to Page 24)

PAYNE GAS APPLIANCES

Equalize Heating Problems



Above: Coliseum at Fort Worth, Texas, designed by Wyatt C. Hedrick and Elmer G. Withers Architectural Co., Inc., assisted by Richard Karl Werner and heated with 65 Payne "CB" Furnaces. Upper Right: One of 88 low-cost homes by Palmer & Sawtell of Atlanta, Georgia, heated with Payne Floor Furnaces.



★ There is really but one purpose in all gas heating problems—to furnish automatically controlled, properly circulated, comfortable warmth in sufficient volume to take care of the space to be heated, and to provide a healthful atmosphere for those occupying such space.

Our purpose is to supply a Payne appliance that will efficiently and economically perform this service whether the problem be to heat a small, low-cost home or to provide comfort for the spectators in large amphitheatres such as the one shown in this space.

Architects, builders, dealers and gas company merchandisers are recognizing the Payne line as being the most complete and Payne heating appliances as unsurpassed in adaptability for every heating requirement.

The benefit of our experience in solving gas heating problems is available to all who care to write to us for free booklet on Payne appliances and gas heating.

PAYNE FURNACE & SUPPLY CO. 336 No. FOOTHILL BLVD. BEVERLY HILLS, CALIF.

Here's a Dramatic Salute

SILENT... YEAR AFTER YEAR
Servel Electrolux is Silent and Different—because it has No Moving Parts!
MILLIONS SAVE BECAUSE IT FREEZES IN SILENCE
Wherever you go, SERVEL ELECTROLUX owners are enthusiastic about the exclusive advantages of this modern refrigerator that
HAS NO MOVING PARTS
Here's why it is silent and different—and why this means more years of dependable, money-saving refrigeration for you!
2 Students Get Fortune For Ice-Making Miracle
How Young Baltzar Von Platen And Carl G. Munters Won Fame And Wealth For Themselves And Others By Solving The Baffling Scientific Problem Of Making Ice From Heat And Eliminating The Need For Machinery Or Moving Parts In Automatic Food Protection.
Still a MIRACLE after 10 Years of Nationwide Popularity—
NEW SERVEL ELECTROLUX
THE DIFFERENT REFRIGERATOR WITH NO MOVING PARTS
SAVES MORE
IT OFFERS MORE YEARS OF SILENT, LOW-COST REFRIGERATION.
See it at your GAS COMPANY OR LOCAL DEALER
NEW LOW PRICES
NEW LOW TERMS
Every Modern Convenience

1

This is an arresting, prestige-type advertisement, with an appealing illustration of a desert scene and the headline "Silent . . . Year After Year." The picture itself gives a reader the impression of the "permanent silence" for which Servel Electrolux is famous. The copy tells a complete story of the silence, economy, and all-round satisfaction of the gas refrigerator, which is supported by proof in the form of statements from satisfied users at the bottom of the page. This advertisement will run as a single page in "The Saturday Evening Post" and "Time" during March, with a combined circulation of 3,584,994 readers, and will reach the upper middle class, home-owning group of consumers.

2

This advertisement takes full advantage of the tabloid technique that is proving so successful today. Beginning with a smashing headline—"MILLIONS SAVE BECAUSE IT FREEZES IN SILENCE"—the advertisement is filled with interesting illustrations and statements from satisfied users. These include testimonials from various types of owners. This advertisement will be run during March in "Collier's," "Liberty," "Good Housekeeping," "True Story," "American Magazine," "Better Homes and Gardens," and "American Home," with a combined reader circulation of 13,458,679.

3

This is a unique advertisement designed especially for the tremendous audience (6,000,000 homes) of the "American Weekly." More than half of the page consists of a dramatic treatment of the romantic, historical, and scientific aspects of gas refrigeration, written in an editorial style resembling that which has helped to build for the "American Weekly" the largest circulation in the world. The March advertisement carries the exciting headline, "2 STUDENTS GET FORTUNE FOR ICE-MAKING MIRACLE." At the bottom of the page is a hard-hitting smash in color, with a consumer-appeal headline and a quick but complete story.

in Servel Electrolux Drive

TO BACK YOUR SALES EFFORT IN 1937

THE BIG PUSH IS ON! Here Are Three of the Powerful Advertising Guns That Will Be Trained on Your Market During the Coming Year. *Three Separate Campaigns . . . Ten of the Nation's Largest Magazines . . .* Mean Over-the-Top Sales for You!

FROM the standpoint of size, aggressiveness, and sheer SALES-POWER, the 1937 Servel Electrolux advertising program is unparalleled in the history of gas appliances.

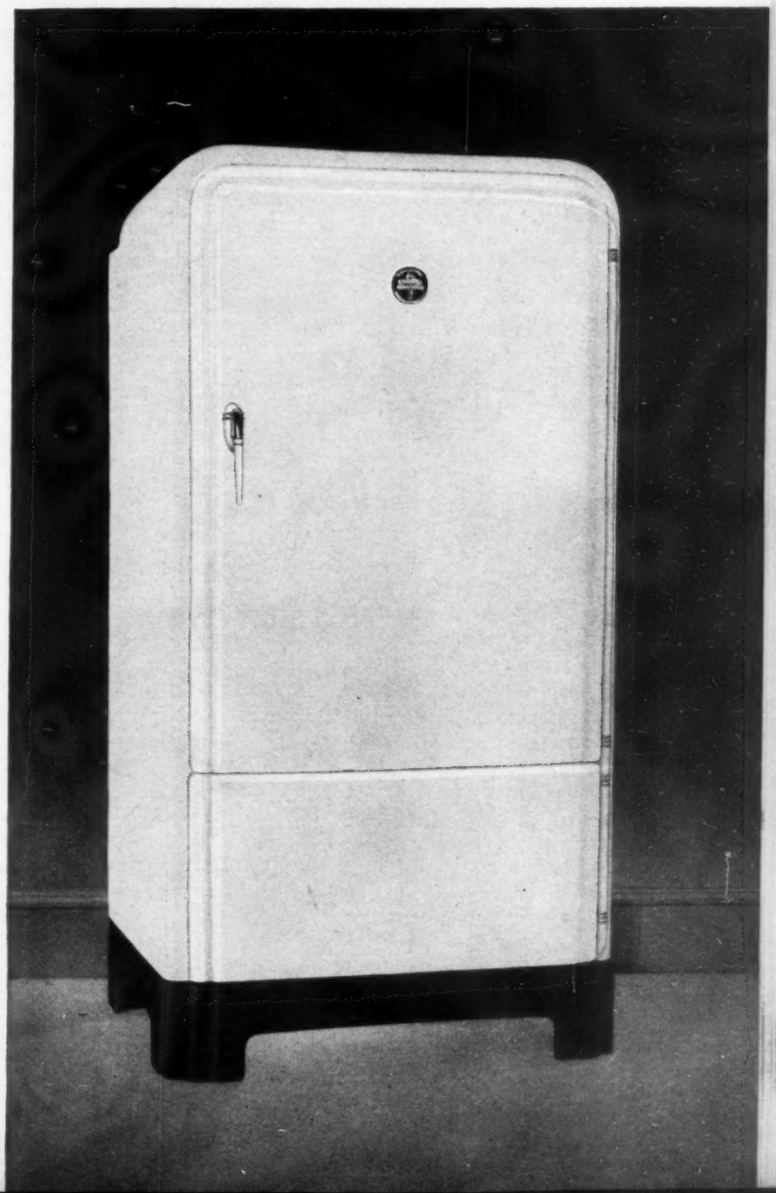
THREE SEPARATE CAMPAIGNS . . . running in TEN OF THE NATION'S LARGEST MAGAZINES . . . will reach an average audience of MORE THAN 23,000,000 READERS A MONTH!

Servel Electrolux has rolled out its HEAVY ARTILLERY. It is laying down a BARRAGE OF STRIKING SALES MESSAGES that will blanket your region, that will prepare the way for the BIGGEST GAS REFRIGERATION YEAR YOU HAVE EVER KNOWN.

And this great drive has already begun.

YOU can MAKE THE MOST of this mammoth advertising program by organizing a concerted drive on YOUR PROSPECTS AT ONCE. Get new models on display immediately, send out literature, tie in with advertising in your local papers, advertise the 1937 Servel Electrolux on the backs of gas bills, attract prospects with outdoor displays, and prepare for a RECORD-BREAKING YEAR WITH GAS REFRIGERATION.

Servel, Inc., Servel Electrolux Sales Division, Evansville, Indiana.



SERVEL ELECTROLUX

THE *Gas* REFRIGERATOR

as: (a) density control of the LICL in the tower, (b) a relay to shut off the gas burners in the event of failure of the control medium—in this case, air, and (c) a high-temperature cut out to limit the temperature of the LICL in the boiler.

While, in the particular system under discussion, city water is used as the cooling medium, it should be pointed out that there are several alternatives to this medium; namely, well water, refrigeration, and, in some cases, water from a cooling tower. Each of these alternatives should be studied to determine which will result in the most economical operation. The reason that city water is used in this application is that the amount required for cooling the LICL is just about equal to that necessary for circulation through the refrigeration condensers used in conditioning the remainder of the building. This results in a total temperature rise of the cooling water of about 30° which makes the use of city water economical.

During the heating season, the summer-winter switch is in the winter position which transfers the controls of the face and by-pass dampers at the entrance to the adiabatic saturator to the wet-bulb thermostat instead of the dry bulb. The wet-bulb also controls the steam valve and the face and by-pass dampers on the preheater coil in the fresh-air intake, so that, as the relative humidity tends to drop, more heat is added to the incoming fresh air and a larger proportion of the total air is passed through the adiabatic saturator. This results in a larger amount of moisture being evaporated into the air. The dry-bulb thermostat controls the steam valve on the reheater coils, giving a constant dry-bulb temperature in the return duct.

A separate exhaust system is provided to exhaust air from the auditorium at a point directly over each of the two cooking ranges located on the stage. This exhaust fan is used both winter and summer and serves to effectively remove all cooking odors resulting from the use of the ranges during cooking demonstrations.

Market Research—An Aid to Greater Commercial Gas Sales

• **Robert F. Elder, Associate Professor of Marketing, Massachusetts Institute of Technology, addressing the Industrial Division Meeting (Commercial), New England Gas Association, Boston, Mass., January 22, 1937.—(Abstract by G A S).**

WHAT does market research have to offer in the field of commercial gas sales? (The field is in this discussion limited to sales to hotels, restaurants, and institutions which use gas primarily for cooking purposes, with some incidental water-heating and space heating.)

ROBERT F. ELDER

To begin with, the Bureau of the Census is developing an excellent general chart of the total market. In its Census of Service Establishments it gives a complete count of hotels and restaurants, by states, counties, and cities and towns. Similar figures may be obtained for hospitals, schools, and other institutions. By comparing this count with its customer and prospect lists, a company can discover whether or not it is covering its market completely. The Census also gives figures on number of persons employed and dollar volume of business done. By developing an index which fairly accurately relates gas consumption to one or both of these factors, it is possible to secure a rough measure of the size of any specific potential market. There are obvious statistical difficulties in doing this, but other industries have solved problems which looked as hard.

What is the value of an index of market potential? The answer is that it makes a good starting point. Knowing the potential, and knowing its own actual sales, a company can calculate its share of the total market. Better yet, knowing this for different sections, it has a yardstick for comparisons. If in one town gas gets 50 per cent of the potential commercial cooking load and in another town only 20 per cent, the sales department can investigate to find out why.

The "potential" figure is a purely hypothetical target. It helps to visualize how much gas could be sold for commercial cooking if all competitive fuels were unavailable. Comparison of company volume with the gross potential reveals how an individual company stands with respect to the combined equivalent volume of its competitors.

The next step is to figure out the volume of business that one's own company can reasonably expect to get. This involves splitting the gross potential down into three categories:

1. Business the company should obtain.

2. Business the company has a chance to obtain.

3. Business the company probably can't obtain.

All potential buyers are not of equal value as prospects. Every salesman knows that perfectly well. But the practical question is "How to separate the sheep from the goats, and keep from spending too much time and expense in trying to sell the poor prospects?" There is a timing problem here, too. It is vitally important to beat competitors to the business where gas has an advantage, or at least an even chance.

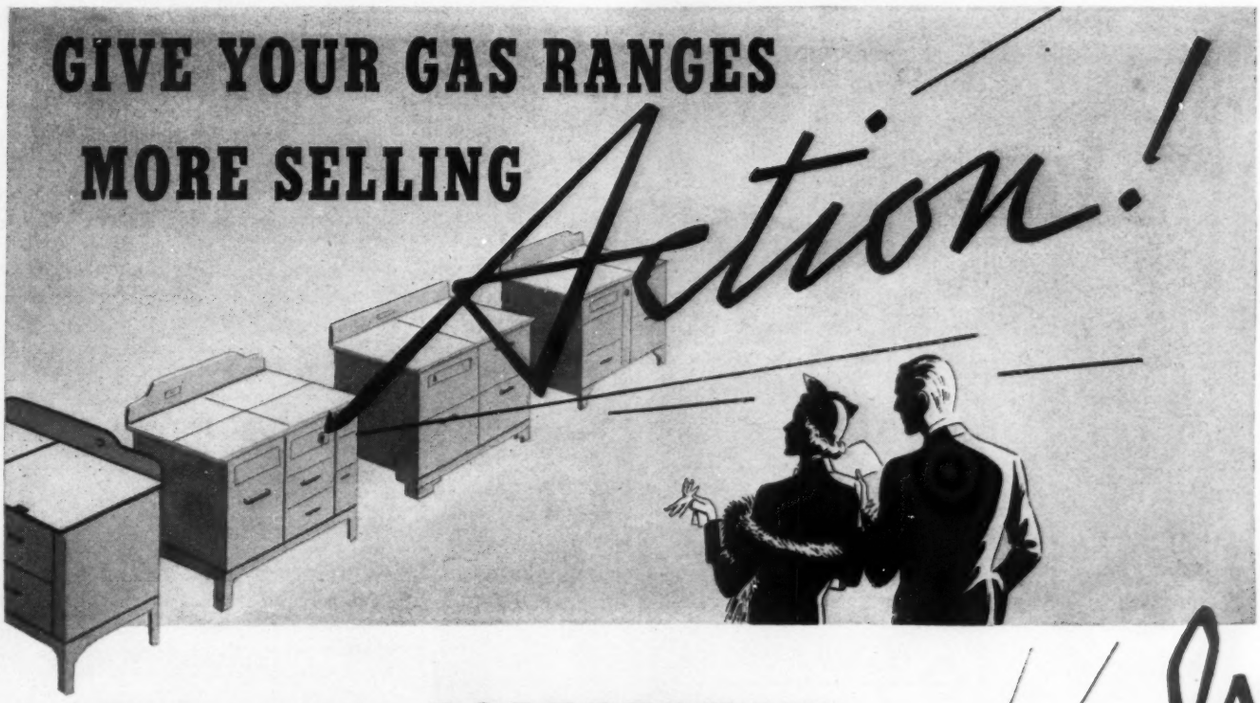
This clearly involves some sort of a system of customer classification in terms of availability. Such a classification cannot be obtained from any compilation of statistics. It must be built up in the field from detailed reports on each potential customer, covering his present equipment, his needs, his prejudices, his financial position, and other pertinent factors. There is no reason why this information should not be built up by salesmen as they cover their territories. Readily usable records covering these points are an invaluable aid in utilizing sales effort most effectively. Alternatively, the records might be built up by making a comprehensive field survey, using a special staff. This is somewhat more costly, but perhaps somewhat quicker. Cross analysis of these records may disclose some significant facts, such as, perhaps, that restaurants with high quality standards are easier to sell on gas, or that certain types of customers replace equipment oftener than others. Such conclusions, when they can be verified, can be put to use in framing the details of the sales program.

Another place where market research can be of real value is in determining what are the motives which influence customers to decide on one type of fuel as against another.

The individual salesman also, when he is dealing with a prospective customer, can add immeasurably to his effectiveness by using the analytical approach. The man who makes himself thoroughly familiar with his customer's operations, his needs, and his problems before he tries to sell him, is actually conducting a little market research operation of his own. In a competitive scramble the man who has the most intimate knowledge of the whole situation has a decided edge, often even enough to offset some of the natural advantages possessed by a competitor who is less well prepared.

Market research is not an extraneous activity. It must grow out of a state of mind, a reverence for facts and a willingness to obey their dictates. When this spirit pervades an organization, the competitive battle is half won.

GIVE YOUR GAS RANGES MORE SELLING *Action!*



GIVE IT WITH ROBERTSHAW

the Oven-Heat-Control that Signals

Action gets the eye! Action gets the business! And it's action that Robertshaw's new Thermal Eye control brings to gas ranges.

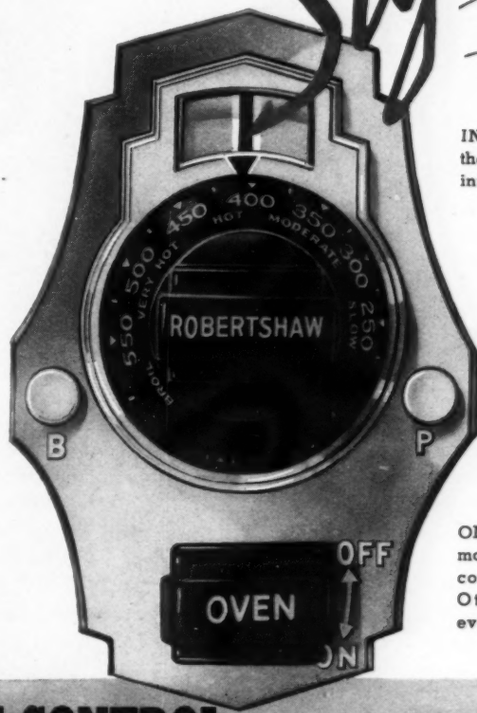
A brilliant red signal swings into view the instant the oven reaches the temperature set on the dial.

It's a stopper, a closer—as your salesmen will find when *they* swing into action. It brings new life to the range, new life to his sales story.

He wants it. Give it to him. Make sure that *your* gas ranges are Thermal-Eye-equipped.

Over 2,800,000 in Use

ROBERTSHAW THERMOSTAT COMPANY
Youngwood, Pa.



IN THE WINDOW the red signal swings into view.

OVEN BY-PASS (B) and safety pilot (P) are easily adjusted.

ON THE BEZEL. This model shows the oven cock on the bezel. Other models for every service need.

ROBERTSHAW OVEN-HEAT-CONTROL *with the* Thermal Eye

TABLE NO. 1—HEAT-LOSS DATA FOR ONE FRAME HOUSE

	Area Sq. Ft.	Heat Conductance Factor	Maximum Hourly B. T. U. Loss
Glass	311	77.0	23,947
9" Frame Walls	1633	18.83	30,749
Ceiling	720	19.59	14,104
Basement Walls 9" Concrete	180	35.84	6,451
Infiltration Loss	12,960 cu. ft.	1.26	16,329
			91,580

Gas required for normal season if fully heated at all times—250,000 Cu. Ft.
Gas required if temperature is set back 10 degrees at night—232,000 Cu. Ft.

The Same House with Insulation, Weatherstripping, and Storm Sash

	Area Sq. Ft.	Heat Conductance Factor	Maximum Hourly B.T.U Loss	Saving in % of Total B.T.U. Loss	Saving in Cu. Ft. of Gas
Glass—Storm Sash	311	42.00	13,062	11.9	27,582
Frame Walls 4" Rock Wool	1633	4.41	7,201	25.7	59,670
Ceiling 4" Rock Wool	720	3.77	2,714	12.4	28,862
Basement Walls	180	35.84	6,451	.... ..	....
Infiltration					
Weatherstripped	12,960	.76	9,850	7.1	16,418
		Totals	39,278	57.1	132,532

Gas required if temperature is set back 10 degrees at night—100,000 Cu. Ft.

Discussions on the Conservation of Heat in Buildings

● **E. W. GETTINGER, St. Louis County Gas Co., Webster Groves, Mo. in a paper entitled, "Heat Conservation in Gas Heated Buildings," from "The Union Electric Magazine," November, 1936; and B. H. ATWOOD, Delaware Power and Light Co., Wilmington, Del., in a paper entitled, "Home Comfort versus the Weather," from the "UGI Circle," December, 1936, and "The Depco Triangle," January, 1937.—(Abstracts by G A S).**

TESTS in houses of the same type of construction, insulated and uninsulated, with outside temperature of zero and an inside temperature of 70 degrees have shown the following temperatures on the inside surface of the walls:

	Uninsulated Degrees	*Insulated Degrees*
Frame (wood siding and sheathing, wood lath and plaster)	56	67
Frame Stucco (stucco, sheathing, wood lath and plaster)	54	66.9
Brick Veneer Frame (4-inch brick sheathing, wood lath and plaster)	57	67
Brick Veneer on Hollow Tile (4-inch brick, 8-inch tile, wood lath and plaster furred)	60	67.2

Few people are familiar with the methods used to insulate old homes, those which have been built and occupied for some time, and it is interesting to know that it can be done at very reasonable cost and with practically no inconvenience to the occupants.

An ingenious machine has been developed by insulation engineers, which works entirely outside of the house.

Mounted on a truck, the machine is brought to the house, trained workmen locate the proper places in the walls, make the necessary openings by removing a few clapboards, shingles, or bricks when the house is of brick veneer construction, and run a hose from the machine to the house. A nozzle is inserted into the heat-stealing air spaces, the machine starts and the insulating material is blown into the hollow walls. Carefully regulated pneumatic pressure forces it into every crack, and the air spaces in all of the exposed walls are filled. The top of the house is treated in the same manner, either putting the insulation directly under the attic floor by removing a few floor boards and blowing it into the spaces under the floor, or by attaching it to the roof between the rafters. When the work is completed a very effective barrier against winter cold and summer heat has been placed in the house. The investment necessary to insulate a house is one which provides two distinct benefits, first,—that of comfort, a warmer house in winter and a cooler one in summer, and secondly,—a reduction of from 10 to 25 per cent in heating costs. The actual savings in fuel costs will balance the investment in insulation in a short time, depending upon the size of the exposed areas of the house which have been insulated.

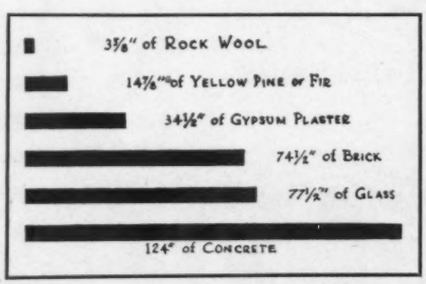


Fig. 1. Comparative Heat Resistance

Surveys made of houses in Wilmington have shown that in the majority of cases the rooms on the second floor are under-radiated. This indicates that, in the past, heat losses through ceilings have not been taken into consideration when the heating systems were installed.

Fig. 1 shows the comparative value of 3⅝ inches of a well-known insulating material.

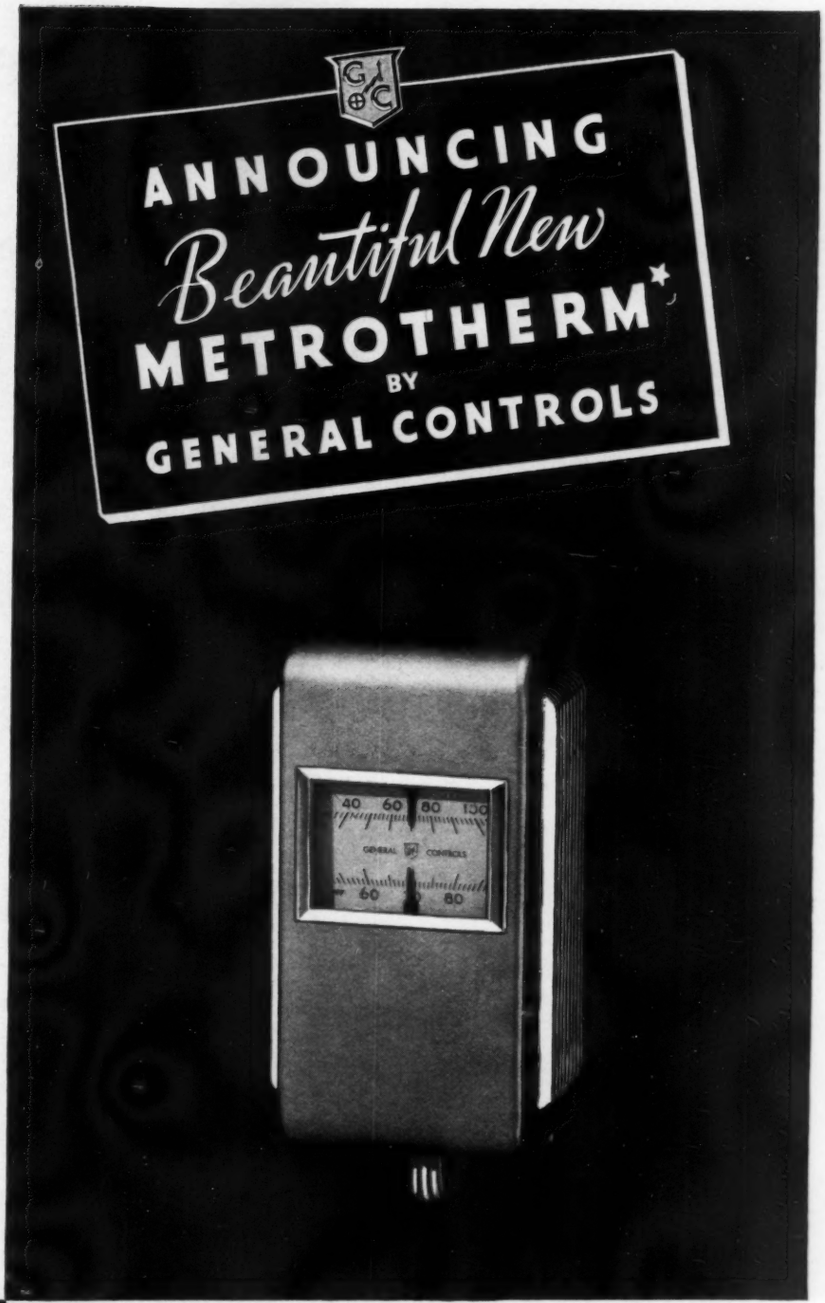
Insulation of attic floors in many instances has compensated for the deficiency in standing radiation, with the result of balancing the system in the home. With automatic heating it is most desirable to have a balanced radiator load which will give uniform heating throughout the house, eliminating drafts and the possible overheating of some rooms.

THE quanity of gas necessary to heat a building with an efficient, automatically-controlled heating plant depends upon the amount of heat that is lost from the building. The heat-loss of different buildings varies greatly, according to building construction. Whether it is a new building or one already built, there are ways of reducing heat-losses through walls, windows, doors and other parts of the structure, so that heat within the building is conserved and the fuel requirements reduced.

These reductions can be accomplished by temperature reduction at night, weatherstripping, double windows and storm doors, prevention of loss from open fireplaces and flues, and insulation.

The heat-loss from any structure may be divided into two general classes; first, losses due to air change, and second, losses due to conduction and radiation. Air change reductions are limited by certain minimum requirements for health and comfort.

In order to discuss and evaluate the practical results to be obtained, a two-



Architecturally Speaking...

This new General Controls room thermostat is a truly beautiful instrument—as simple and graceful as a fine watch. Slender indicators point out the setting and the actual temperature. Vertical louvres allow free circulation of air, yet completely conceal the internal mechanism. Luxuriously finished in satin-silver and chrome.

SEND COUPON FOR . . .

GENERAL CONTROLS
1370 Harrison Street
San Francisco, Calif.

Gentlemen: Without obligation please send

[Please mark]

☐ Booklet giving complete data on the new METROTHERM

☐ 1937 catalog illustrating the full line of General Controls temperature and flow controls

Name_____

City_____ State_____

M-178

COPYRIGHT GENERAL CONTROLS 1937

FROM THE ENGINEER'S STANDPOINT

This new General Controls Thermostat is of **low thermal inertia** and embodies a mechanism which allows for **adjustable heat acceleration.** With this feature the heat acceleration can be easily "tuned" to the load characteristics and type of installation—thus allowing maximum sensitivity and quick response to small temperature change on any job. Precisely accurate and positive in action. Available with timer. Locking device standard at no extra cost. Fill out the attached coupon and send it today for complete engineering data.

GENERAL CONTROLS

NEW YORK • CLEVELAND KANSAS CITY • SAN FRANCISCO

AS MODERN AS AIR CONDITIONING

story dwelling was selected, of fairly good frame construction, clapboard siding, slate roof with unfinished, unheated attic, horizontal cross section 30 feet by 24 feet; ceiling height, first floor, 9 feet; ceiling height, second floor, 8 feet. This house is uninsulated, has double hung sash windows with single glass and is not weatherstripped. It has a hot water heating system with a plain type thermostat and the temperature is not reduced at night. The gas required to heat this house for a normal season would be 250 M c.f.

Peoples Gas Light Cooking Carnival Features Colorfully Costumed Cooks

WITH nine complete kitchen exhibits, a Full-Flavor Cooking booth, with unusual attractions such as six-year-old Barbara Jenkins, cooking expert, and added daily special features, the Peoples Gas Light and Coke Co., Chicago, Ill., held a two-weeks' Cooking Carnival in the main building from February 23 to March 6.

During the first week, in addition to the demonstrations by Barbara Jenkins and range demonstrations, there were demonstrations on broiling, cake decorating, breakfast preparation in 10 minutes, quick grilling, and flower arrangements for the table; a kitchen apron contest; a kitchen apron parade, with prizes for the best design; and tours of the model kitchens.

Special days marked the second week. March 1 was International Day. Demonstrators in colorful costumes of foreign countries prepared Polish, German, Scandinavian, and Italian dishes. A show was also presented by the Wheat Flour Institute on "The Breads of All Nations."

Other demonstrations during the second week included vegetable cooking; breakfast for two in seven minutes; baking a cake for two; flowers for the bridal table; preparation of poultry, meats, fish, Lenten foods, cold dishes, and dairy products; cookie and cake baking, and spun sugar decorations.

On the final day of the Carnival a children's party was held, with a puppet show, a chalk talk, group singing, and prizes for the best cakes baked by children.

In preparing for the Carnival, which attracted throngs daily, the main floor, salesroom, and Home Service auditorium were redecorated and new, diffused lighting installed. A gas range exhibit, probably the most complete ever presented by a gas company, was arranged throughout the space devoted to Carnival activities. For the first time in the company's history, every display window in the gas building showed gas ranges.

The nine model kitchen exhibits included "American's Finest," and the "Sunshine Kitchen." All nine kitchens are permanent displays. Other permanent exhibits included a Japanese tea garden, cheeses of all nations, and foods for increasing and reducing weight.

International Day was a special feature of the two-weeks' Cooking Carnival presented by The Peoples Gas Light & Coke Co., Chicago. Elizabeth Lynahan demonstrated Italian cooking.

■ ■

Community Public Service Co. Makes Staff Changes

Community Public Service Co., Fort Worth, Texas, announces the following change in personnel:

S. A. Clark, sales manager and accountant of the northeastern division, will act as sales supervisor in the merchandise department, general office. He succeeds R. A. Grogan, resigned.

Eugene Parker, accountant, central division, has been transferred to Farmersville as division accountant and sales manager.

Joe Bailey Karnes, Goldthwaite plant operator, has been appointed local manager at Richland Springs. O. C. Lacewell, former manager, has resigned.

Leslie Cooke has been promoted to the position of auditor of disbursements. Frank Cardwell, former auditor of disbursements, died of pneumonia on January 10.

■ ■

Deming System Spends $7000 On Service Extensions

New mains and service connections costing $7000 have been built by the Deming Gas System, Deming, N. M., to meet the rapidly increasing demand, according to A. J. Noyes, superintendent. Extensions were financed by a P.W.A. loan and grant of 45 per cent, and other extensions will be made as fast as possible out of earnings.

The system, valued at $40,000, in January was serving 219 customers, mostly domestic.

Gas is obtained from the main line of the El Paso Natural Gas Co., which passes near Deming and which has a line to the Deming power plant.

A. E. Higgins Resigns as Natural Gas Dept. Secretary

CAPTAIN A. E. HIGGINS, secretary since 1931 of the Natural Gas Department, American Gas Association, has resigned and on March 15 will become vice-president of the Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

A. E. HIGGINS

Mr. Higgins joined the A. G. A. in 1927 as field representative. For three years prior to that time he was an instructor at West Point Military Academy in the department of motors and material, and before that he was instructor at Fort Sill, Okla., in the Field Artillery School of Fire, department of material motors and equipment. Captain Higigns served in France during the World War, and previously was with the army in Mexico during the Villa expedition.

In accepting the resignation of Captain Higgins, Alexander Forward, managing director of the American Gas Association, expressed his regret at losing the secretary of the Natural Gas Department and recounted how Captain Higgins had secured and retained the friendship, confidence and esteem of the members of the natural gas industry, successfully planned and carried out the conventions, committee, and other meetings, secured information desired by the members, and collected and disseminated the important news of the industry.

■ ■

Northern Natural Sponsors Musical Radio Series

Thirteen half-hour radio programs make up the series, known as "The Northern Naturals," broadcast by Northern Natural Gas Co., Omaha, Neb., on Sunday afternoon over Station WOW and KOIL, Omaha. Radio time is 3:00 to 3:30 p. m., C.S.T. The series started on January 10 and will close April 4.

The programs, featuring music, are dedicated to the 155 towns and cities in Iowa, Nebraska, Kansas, South Dakota, and Minnesota served by Northern Natural Gas Co. This is the company's first use of a regular radio program.

■ ■

Texas. Co. Reduces Rates

The Texas Railroad Commission has approved a voluntary reduction by the West Texas Co., Lubbock, Texas, of consumer rates applicable in 42 plains and west Texas cities. It was the second reduction in two years on the system. New rates are lower on the first 4000 feet.

■ ■

Harrisburg Co. Loses Evans

Earl Edwin Evans of the distribution division of The Harrisburg Gas Co., Harrisburg, Pa., died on January 2 at the Johns Hopkins Hospital, Baltimore, Md. He joined the company as engineering assistant in 1924.

YES . . DETROIT JEWEL *and* GARLAND GAS RANGES ARE NOW AVAILABLE IN SIX BURNER MODELS

Our 1937 lines of Detroit Jewel Gas Ranges and Garland Gas Ranges now include every size model necessary to fulfill the demands of your market.

• • •

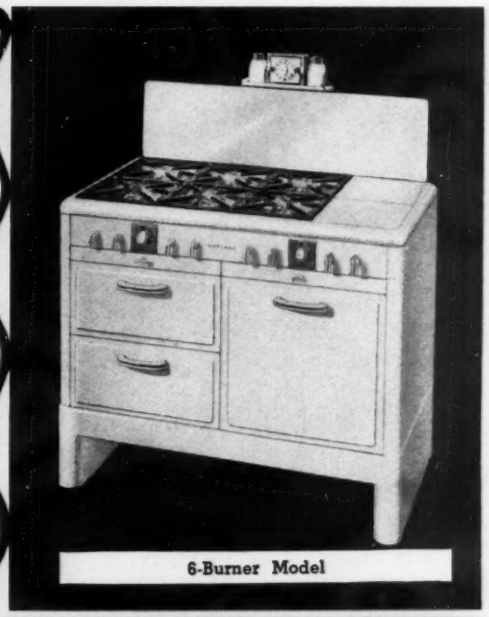
Because it is upon the efficiency of appliances that the efficacy of gas as a superior, economical fuel depends, we, the makers of Detroit Jewel and Garland Gas Ranges, recognize our great responsibility to the Gas industry.

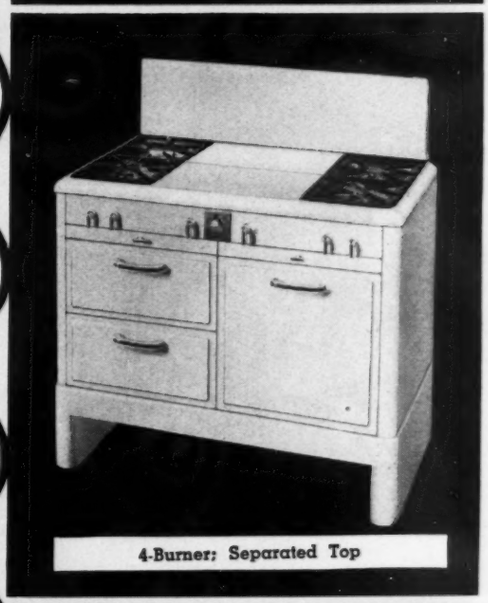
That is why we unceasingly strive to make our products capable of fully interpreting the true, finer merits of gas as a cooking and heating fuel.

From the smart new hinged cover top; the chrome top burners with simmers; new style top grates and flush, one-piece cooking top; smokeless broiler with chrome pan and rack; heavy, insulated, one-piece oven; down through the entire list of features on these beautiful ranges, their construction and performance have been faithfully developed to prove that "a fine GAS RANGE renders the best cooking service in the world".

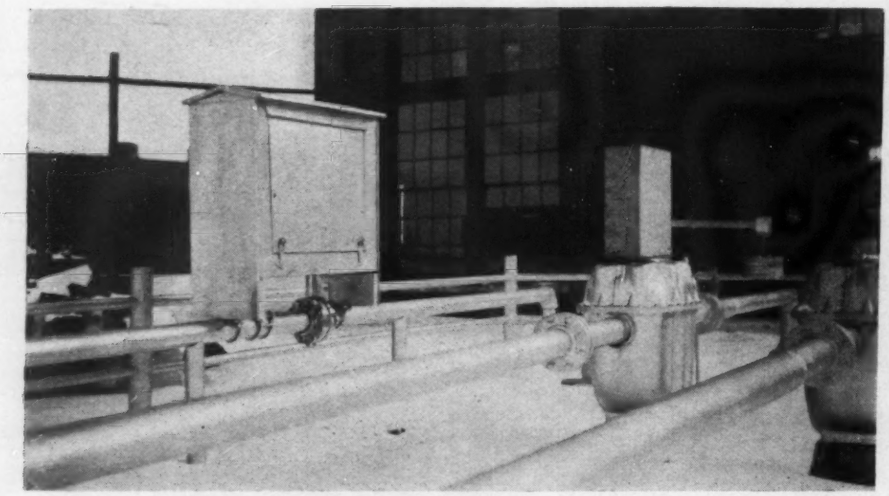
GAS IS THE IDEAL FUEL
and at its best when used with Detroit Jewel and Garland Gas Ranges.

DETROIT - MICHIGAN STOVE CO.
DETROIT, MICHIGAN


6-Burner Model


4-Burner: Separated Top

4-Burner: Standard Top



Meter setting at the Shawnee Rock Island roundhouse, where the Oklahoma Natural Gas Co. supplies gas for the preheating of locomotives.

Oklahoma Natural Converts Railroad to Gas for Preheating Locomotives

By F. M. ORELUP

Oklahoma Natural Gas Company

THE roundhouses of the Chicago, Rock Island & Pacific railroad shops at Shawnee and El Reno, Okla., have recently been piped to use natural gas for the preheating of locomotives. Oklahoma Natural Gas Co., Tulsa, serves these places. The gas has replaced oil and is proving to be of advantage in more ways than usually experienced in oil to gas conversions.

A 4-inch welded line was laid on the roof of the roundhouse to avoid engine pits, steam lines, etc., with due allowance being made for a 100° F. line temperature change from winter to summer. A drop of 2-inch pipe is installed at each locomotive stall. High pressure air hose of 1-inch inside diameter supplies gas from the drops to the burner nipple. A short burner pipe or nipple is permanently connected to the oil burner used in the regular firing when the locomotive is on the road. Approximately 3 lbs. gas pressure is maintained just ahead of the burner.

Metering equipment at Shawnee consists of two positive meters and one differential relief valve that turns in an orifice meter when more than one engine is being fired.

The gas consumed is about one half the equivalent oil as no gas is wasted. It was necessary to kindle the oil until a fair degree of fire-box temperature was attained. The unburned oil at the beginning of oil firing had a tendency to run to the work pits under the engines. Some of the partially burned oil formed coke in the fire-box which made cleaning necessary. The use of gas has eliminated such troubles.

The tender, with its oil firing mechanism, may be worked on in one shop while the locomotive is being repaired in another. The locomotive can make short moves on gas made steam.

Locomotives are fired with a forced draft induced by a steam jet in the smoke stack. When preheating was done with oil the steam required for this purpose was a considerable item. The gas requires very little induced draft for proper combustion so a saving in boiler-house steam results. The customary saving in steam due to necessary atomization of fuel oil is also effected.

The volume of gas required to bring a locomotive up to full steam pressure varies with size of engine and condition of heat at beginning of the firing. An average gas consumption for 100 locomotives was 7 M c.f. of 1100 B.t.u. gas. This figure includes all locomotives heated with gas. Some had as much as 40 lbs. or more of steam remaining when ready to be refired. Others were cold. The larger cold engines require as much as 15 M c.f. each.

The savings effected using gas may be summed up as follows: (1) Much higher heating efficiency. (2) No oil in work pit. (3) No coke troubles in fire-box. (4) Less boiler house steam necessary. (5) More adaptable to work routine. (6) Boiler heats up more evenly.

■ ■

Western United Separates Gas and Electrical Sales

Western United Gas & Electric Co., Aurora, Ill., under a reorganization of its merchandise sales department, has separated the department into a group selling gas merchandise exclusively and a group selling only electrical merchandise. Additional salesmen have been added.

Daniel Garrity heads the gas merchandise sales division under Vice-President C. H. Kallstedt and C. W. Tennant, general sales manager. The 1937 quota for this division is $450,000, a 50 per cent increase.

Brooklyn Union Records 1936 As Banner Sales Year

A NEW annual load of more than a billion and a half cu. ft. was added to the business of The Brooklyn Union Gas Co., Brooklyn, N. Y., during 1936, and gas appliance sales reached the all-time high of $3,075,491.91. This sales record exceeds by nearly $600,000 the best previous record of the company.

Sales were 46 per cent higher than in 1935. Refrigerator sales gained 9 per cent over the preceding year. Water heater sales were up 267 per cent. House heater sales showed a gain of 1937 per cent, showing the effect of the new low rate which put gas in the territory the company serves on a competitive basis with other fuels.

Gas range sales lacked only 121 of reaching the mark of 1935.

A total of 27,711 appliances were sold in 1936. Of these 2439, or about 9 per cent, resulted directly from leads turned in by employees.

Following the company's record year, sales in January, 1937, were the best of any January in the company's history. They totaled $134,279, topping the previous record, set in 1932, by $16,595.67. Sales were 48 per cent better than in January, 1936.

■ ■

D. A. Buckler, So. Cal. Gas Co. Advertising Chief, Dies

Douglas A. Buckler, advertising director of Southern California Gas Co., Los Angeles, died at his home in Beverly Hills on February 16.

D. A. BUCKLER

Highly esteemed in the gas industry and the advertising profession, Mr. Buckler had been associated with the gas company for the last six years. Prior to that time he was advertising manager of the Bank of America in Los Angeles.

Mr. Buckler was a member of the Advertising Club of Los Angeles and a director of that organization in 1934. He was also active in committee work for the Pacific Coast Gas Association.

■ ■

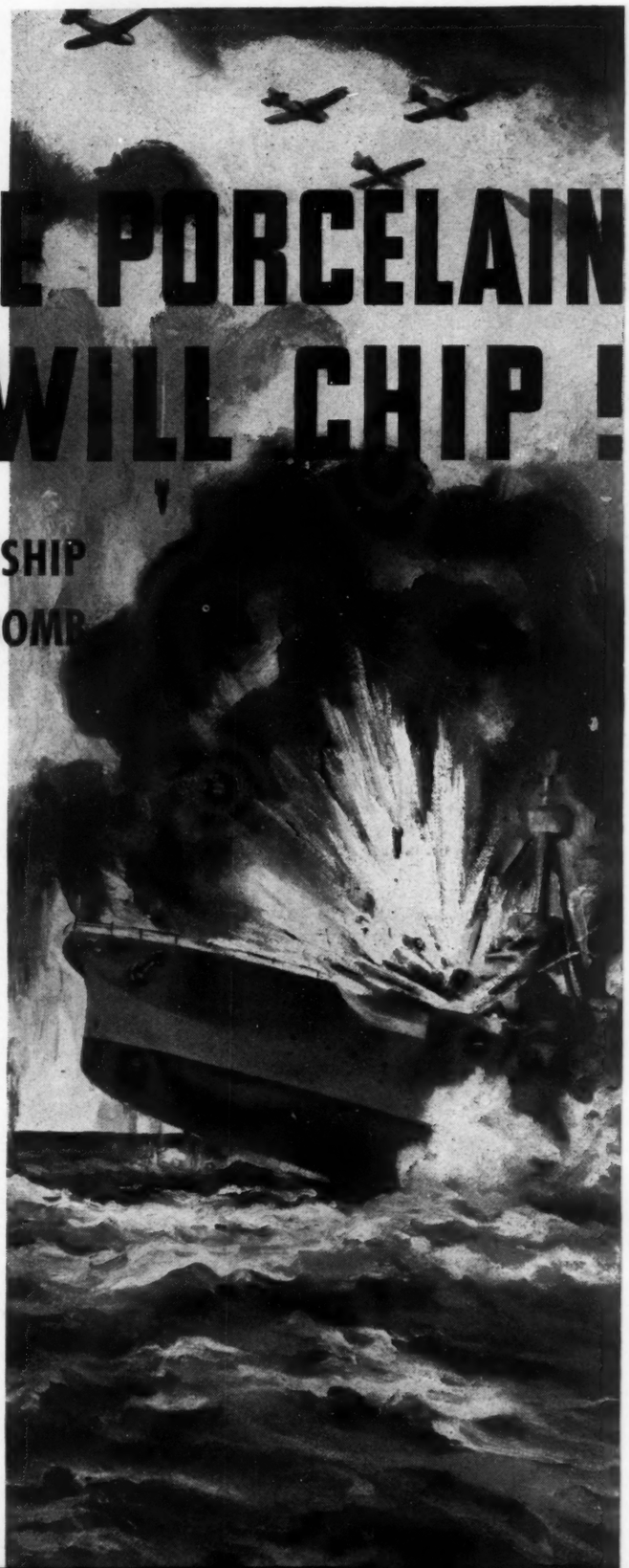
Larned, Kan., Votes to Build $160,000 Gas System

Work on a municipal gas distribution system for Larned, Kan., will be started soon as a result of a special bond election in February at which funds were voted for the project.

The system, to be municipally owned and operated, will include 8 miles of gas mains in the city. Producers Gas Co. will build 21 miles of transmission lines to bring the gas to the city limits from the Otis, Rush, and Barton county wells.

The project will cost approximately $160,000, and will be completed before November, 1937.

OF COURSE PORCELAIN ENAMEL WILL CHIP!



. . . SO WILL A BATTLESHIP IF YOU HIT IT WITH A BOMB

Let's talk about this matter of chipping frankly —and sanely. Porcelain enamel *will* chip, of course—if you hit it hard enough. It is a mineral substance—hard as glass. —But housekeepers don't clean mirrors, windows, refrigerators or sinks with a smithing hammer! —Considering the millions of mirrors and plate glass windows in use —how many ever break? A small fraction of 1 per cent! —Now suppose all those millions of mirrors were backed up with a sheet of steel—how many would break? A very precious few!

The fact that porcelain enamel is hard enough to chip, under very heavy impact, is a big feature in its favor. Being so hard—porcelain enamel is the one finish that won't scratch or dull or lose its lifetime lustre. Being flint-hard, porcelain enamel is the one finish in which delicate colors will never fade; the one finish that is absolutely non-absorbent. Being as hard as glass, it is clean, sanitary, enduring.

Porcelain enamel is the one sales feature which gives lifetime satisfaction. Feature it—talk it—push it—sell it. Be glad porcelain enamel is hard enough to chip. If it wasn't, it wouldn't be porcelain enamel.

EDUCATIONAL BUREAU
PORCELAIN ENAMEL INSTITUTE, Inc.
612 North Michigan Avenue • Chicago

PORCELAIN ENAMEL THE *Lifetime* Finish

Members of the General Committee of the Southwestern Gas Measurement Short Course who met recently to plan the 1937 course. Standing, left to right: Max Watson, L. G. Rheinberger, Earl Knightlinger, Kate A. Niblack, G. B. Lane, J. H. Satterwhite, G. W. McCullough, A. E. Higgins. Front row: W. H. Carson, W. R. McLaughlin, E. E. Stovall, Gilbert Estill, F. C. Walters.

Committee Plans April Meeting For Southwest Gas Measurement Course

THE 1937 Southwestern Gas Measurement short course will be conducted April 20-22, according to plans made by the general committee at a February meeting at the University of Oklahoma, Norman, Okla. E. E. Stovall is chairman of the General Committee. Gilbert Estill, Oklahoma Natural Gas Co., Tulsa, is chairman of the Program committee; W. H. Carson, University of Oklahoma, chairman of the Banquet and Local Arrangements committee; Max Watson, Canadian River Gas Co., Amarillo, Texas, chairman of the Exhibits committee; G. W. McCullough, Phillips Petroleum Co., Bartlesville, Okla., chairman of the Publications committee; Miss Kate Niblack, Oklahoma Utilities Association, Oklahoma City, chairman of the Registration and Publicity committee; L. G. Rheinberger, chairman of the Practical Methods committee.

Miss Kate Niblack, acting secretary of the Oklahoma Utilities Association, was elected as a permanent member of the committee representing the Oklahoma Utilities Association.

The next meeting of the committee will be held in Tulsa during the Oklahoma Utilities Association Annual Meeting, March 22.

Wisconsin Rapids Co. Shows 50 Per Cent 1936 Increase

WISCONSIN Rapids Gas Co., which serves propane gas on a meter basis in Wisconsin Rapids and neighboring towns, made a 50 per cent increase in business during 1936, added a mile of mains, installed a 564-foot pipe line across the river to serve Wisconsin Rapids from the central storage tank, and conducted a series of eight cooking schools. The number of shareholders increased about 20 per cent.

Lee Barker, general manager, states that turnover in customers is less than 3 per cent. The company is entering its fourth year of operation in Wisconsin Rapids and vicinity.

The gas company now serves more than 500 customers. Of these, 160 were added during 1936. In 1935 the company added 145 new customers. Service during the past year was extended to Adams, Friendship, Rudolph, Wild Rose, and Almond. Other territories served, in addition to Wisconsin Rapids, are Nekoosa, Port Edwards, Plainfield, Hancock, Coloma, Biron, Wautoma, and Pittsville.

The company now uses a tank car of gas monthly. The meter service consists of mains and services from the company's large storage tank and also a single tank system served by a tank truck. Some customers are on a two-tank system.

Sales of gas refrigerators increased 50 per cent during the year.

■ ■

Lone Star Honors Chase

First portrait to be hung in the new hall of records of the Lone Star Gas Co., Dallas, Texas, will be that of Frank L. Chase, vice-president and operating manager, who has been nationally prominent in the gas industry for 36 years. The painting, gift of his associates, was presented at a luncheon in Mr. Chase's honor. L. B. Denning, president of Lone Star Gas System, made the presentation address.

■ ■

Pacific G. & E. Holds Contest

Pacific Gas and Electric Co., San Francisco, Calif., is offering $50 in prizes to P. G. and E. customers in an essay contest on the subject, "Gas Heat Is Best." Essays are not to exceed 200 words. The company recently completed a contest on "Cooking on the Table."

N. T. Sellman Elected to A.G.A. Executive Board

NILS T. SELLMAN, assistant vice-president, Consolidated Edison Co. of New York, has been elected a member of the executive board of the American Gas Association. Mr. Sellman fills a vacancy existing on the board.

Graduated from Stevens Institute of Technology, Mr. Sellman entered the gas business with the Consolidated Gas Co. of New York as test engineer of gas appliances. In 1921 he became service engineer for the American Gas Association, and later, assistant secretary-manager. He devoted considerable time to the formation of the A.G.A. Testing Laboratory in Cleveland. He rejoined the Consolidated Gas Co. of New York, as engineer of utilization in 1925, was appointed assistant secretary in 1928, and later, assistant vice-president.

Mr. Sellman was the first winner of the A.G.A. Charles A. Munroe Award, which he received in 1929 for his pioneering work in connection with the development of the gas refrigerator.

■ ■

San Diego Co. Appoints Glasgow La Mesa Head

Howard Glasgow has been promoted by the San Diego Consolidated Gas & Electric Co., San Diego, Calif., to the position of manager of the office in the La Mesa district, which includes several communities. Mr. Glasgow for nearly eight years was manager of the company's office in National City. He has been with the company for 13 years.

George Irey, former cashier in the Chula Vista branch office, succeeds Mr. Glasgow as manager in National City. Franklin Chapman, of the National City office, takes over Mr. Irey's position in Chula Vista, and Fred Wright of San Diego succeeds Mr. Chapman in National City.

■ ■

S. R. Dresser Co. Announces Personnel Promotions

S. R. Dresser Manufacturing Co., Bradford, Pa., manufacturers of flexible pipe couplings and pipe-line repair devices, recently promoted M. N. Davis from vice-president in charge of sales to executive vice-president. He will continue as secretary of the company.

H. P. Boncher, formerly assistant sales manager, has been made sales manager. R. E. Reimer, treasurer, takes on the additional duties of assistant general manager. H. N. Mallon continues as president and general manager. F. A. Miller is chairman of the board.

■ ■

Texas Cotton Plant Buys Natural Gas Engines

Three natural gas engines to generate power for a cotton manufacturing plant have been sold by Lone Star Industrial Engineers, according to E. J. Hatzenbuehler, head of the Lone Star company. Itasca Cotton Manufacturing Co. is the purchaser, and is the first such plant in Texas to use natural gas engines instead of buying electricity.

P. K. Griffin of Lone Star is the engineer in charge of installation.

MAGIC CHEF

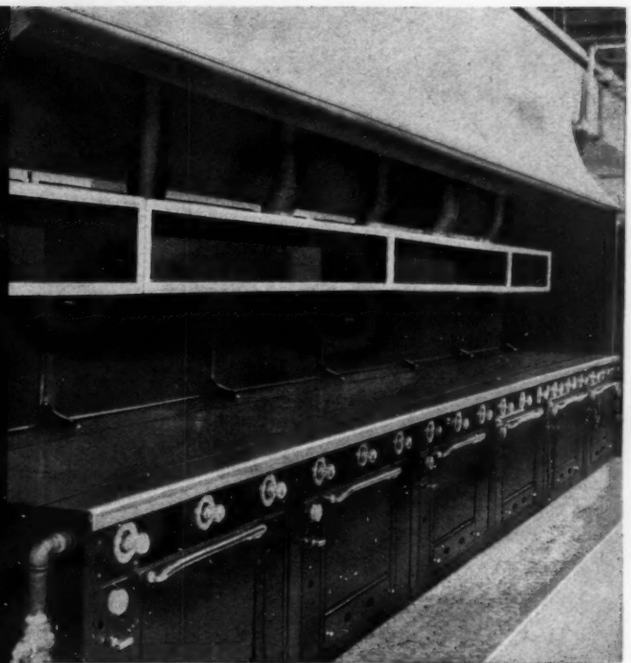
UNIFORM HEAT TOP

FAST TOP COOKING

SUBSTANTIAL GAS SAVINGS

UNIFORM HEAT CONTROL

INCREASED CAPACITY

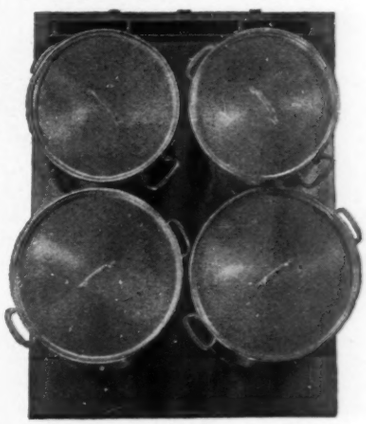


Magic Chef Heavy Duty Equipment with Uniform Heat Tops in the main restaurant of Marshall Field & Co., Chicago.

MODERN restaurants, hotels and institutions favor Magic Chef Heavy Duty equipment because it is designed and built to meet present-day requirements of speed, economy, cooking capacity and flexibility. • The Uniform Heat Top provides a fast top cooking area with accurate uniform heat over the entire top cooking surface of the Magic Chef Heavy Duty gas range. • The Top Heat Control is simple, positive and accurate. Top burners light automatically when gas is turned on. Any desired degree of heat can be secured readily by a mere turn of the graduated dial. • If you are interested in faster, better, more economical cooking, write for details.

The contents of four large kettles can be cooked at the same time on one 32-inch unit at fast, medium or slow heat or at varied temperatures on each cooking plate, if desired. Four center fire ranges would be required to do the same amount of fast cooking in the same time and temperature.

The heat is positive and satisfactory because it is even all over the entire cooking surface while on center, front and side fire tops the heat is graduated from high to low temperatures.



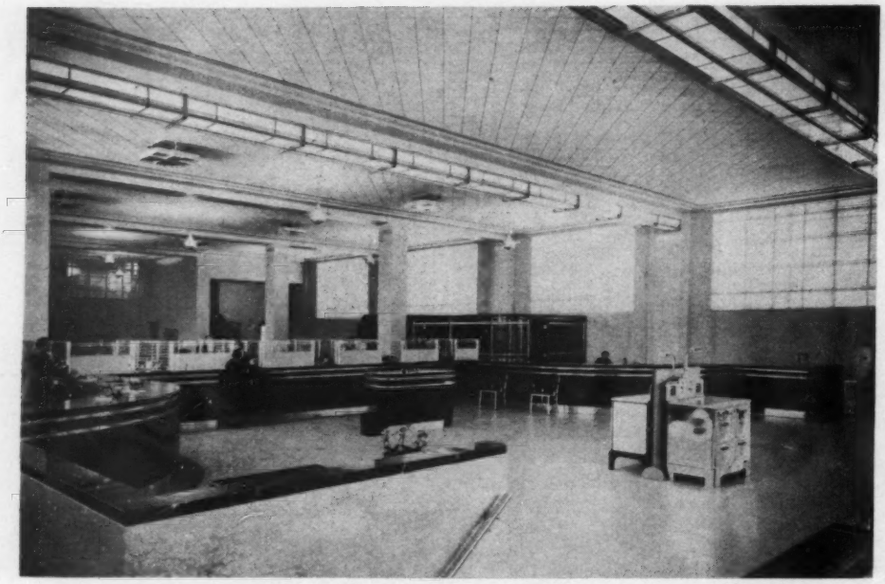
AMERICAN STOVE COMPANY

BOSTON • NEW YORK • ATLANTA • CLEVELAND • CHICAGO
ST. LOUIS • PHILADELPHIA • SAN FRANCISCO • LOS ANGELES

Magic Chef
AMERICAN STOVE COMPANY

LOOK FOR THE RED WHEEL WHEN YOU BUY A MAGIC CHEF

MAGIC CHEF HEAVY DUTY *Automatic Equipment* **FOR MODERN GAS COOKING**



Interior view showing the modern and well-lighted design of the Los Angeles Gas and Electric Corp.'s new Hollywood office.

L. A. G. & E. Opens Hollywood Office

OFFICIALLY previewed and dedicated to the service of the community by Addison B. Day, president and general manager, the new $150,000 Hollywood office of the Los Angeles Gas and Electric Corp. was opened for general business on February 15. Lester E. Green, former assistant manager of customers department, is in charge.

LESTER GREEN

The new gas service building is the fifth district office to be erected by the Los Angeles corporation in its system, the others being in Pasadena, Alhambra, Huntington Park, and Inglewood. In line with a policy of decentralization of customer service facilities, 50,000 accounts in the Hollywood area, together with a staff of 65 service people, have been transferred from the company's downtown office.

As a result of experience gained in the erection of the four other district office buildings, the utility company incorporated in the new Hollywood office latest provisions for business efficiency and customer convenience, service, and education. A spacious main floor at ground level and a mezzanine floor over the rear portion, houses bookkeeping and collection facilities, while a basement, running the full length of the building, is given over to an auditorium for home economics demonstrations, appliance display rooms, and a model all-gas kitchen.

Assisting Mr. Green are William M. Fisher, formerly assistant paymaster, now assistant manager; F. T. Mayes, in charge of collections; Paul Hoshaw, in charge of bookkeeping; and William C. Lembke, who for some years managed the Hollywood branch office, in charge of contracts and orders.

The home service department will be under the direction of Miss Cleo Kerley, home economist, while Mrs. I. S. Bell, appliance counselor, will have charge of the appliance display rooms and model kitchen.

■ ■

Koppers Co. to Construct Gas Purification Plant

The Chartiers Oil Co., Pittsburgh, Pa., has awarded a contract for the construction of a natural gas purification plant at Wayne, W. Va., to Koppers Company's Engineering and Construction division.

The plant will employ the new Koppers sodium phenolate process, and will recover 95 per cent of the hydrogen sulfide in the gas. It will have a capacity of 5,000,000 cu. ft. a day.

Construction will begin in June, and the plant will be ready for operation by September. This will be the third plant to employ this new Koppers patented process for the recovery of hydrogen sulfide from natural gas, coke oven gas and refinery still gases.

■ ■

E. E. Kuehn, T. J. Skrabanek Elevated by Lone Star

Lone Star Gas Co., Dallas, Texas, has appointed E. E. Kuehn, formerly chief clerk, as assistant valuation engineer. Before joining Lone Star in 1931, Mr. Kuehn was with the Texas Power & Light Co., the San Antonio Public Service Co., and the Municipal Gas Co. (later a property of the Lone Star System).

T. J. Skrabanek on January 1 became assistant industrial engineer for Lone Star. For several years he has been engaged in industrial work in the Waco division. He joined the company in 1928.

Portland Co. Names Steele Residential Sales Manager

C. W. STEELE was named residential sales manager, commercial department, Portland Gas & Coke Co., Portland, Ore., on February 11, according to the announcement made by John J. Winn, Jr., commercial manager.

C. W. STEELE

Mr. Steele will have charge of the residential sales crew of 35 salesmen in the Portland area and 15 salesmen in other towns served by Portland Gas & Coke Co. — Vancouver, Washington; Hillsboro, Oregon City, Salem, Corvallis, Albany, Silverton, Mt. Angel, Woodburn, Newberg, and nearby towns. He will direct residential selling among the company's 86,000 customers.

Mr. Steele has been in the commercial department for six years. A graduate of Oregon State College in mechanical engineering, he joined Portland Gas & Coke Co. in 1928 as a draftsman in the engineering department, coming to the gas company from the engineering department of the Long Bell Lumber Company, Longview, Wash.

After three years as a draftsman in the gas company engineering department, he was transferred to the commercial department and has been in selling activities since.

Mr. Steele succeeded Joe D. Ingram, residential sales manager for a year and a half, who resigned.

■ ■

Illinois Utilities Sales Tax Held Unconstitutional

ILLINOIS' 3 per cent utilities sales tax, passed in 1935 to raise relief funds, was declared unconstitutional by the State Supreme Court in a decision handed down on February 12. The court held that the entire act was invalidated because it exempted sales of gas, water, and electricity for industrial use.

Taxes paid by utilities under protest have not been turned over to the Illinois Emergency Relief Commission but have been kept in a separate fund awaiting the court decision, and it is expected the money will be returned to the protesting utilities if a rehearing is denied.

■ ■

Texas Gas Line Completed

A natural gas line has been completed from the La Blanca oil field in Hidalgo County, Texas, to the Mercedes natural gas line. The Mercedes line was recently constructed to connect with the Rio Grande Valley Gas Co. line, from which all valley towns get their gas.

■ ■

Co. Holds Sales Conference

Northern States Power Co., Eau Claire, Wis., recently held its second gas conference for the Wisconsin division at Winona, Minn. Ninety representatives of gas sales and promotion departments in the division attended.

MUELLERAIRE GAS UNITS WIN ACCLAIM OF STORE OWNER!

Joliet Furniture Dealer praises economy of Muelleraire

Opens Store 8 A. M. Warm in 15 minutes

Here's sales ammunition for any utility company that wants gas load. Read carefully every word of the following letter. It tells a simple direct story of the cleanliness, convenience, economy and all-around satisfaction of the Muelleraire. This letter also is chock full of sales ideas which your men can use to sell gas heat to stores, offices, shops, restaurants, show rooms, small factories, etc., which are without central heating plants.

Here are excerpts from the interesting letter of Joseph J. Smith, of Smith-Fitzgibbons, Joliet, Ill.:

"When we heated our store with oil and coal, there was always a film in the air. This settled on our upholstered furniture. Dust then accumulated on the film and we had to be careful to keep customers from rubbing their hands over the furniture. If women wore white gloves, the film stained the gloves.

"When we used steam heat we had trouble with joints of furniture drying up. We also had to decorate every two years but it should have been done every year. With gas heat we will not have to decorate but every six years. The area of our store is 30,000 square feet. It costs more than $800 every time the job has to be done.

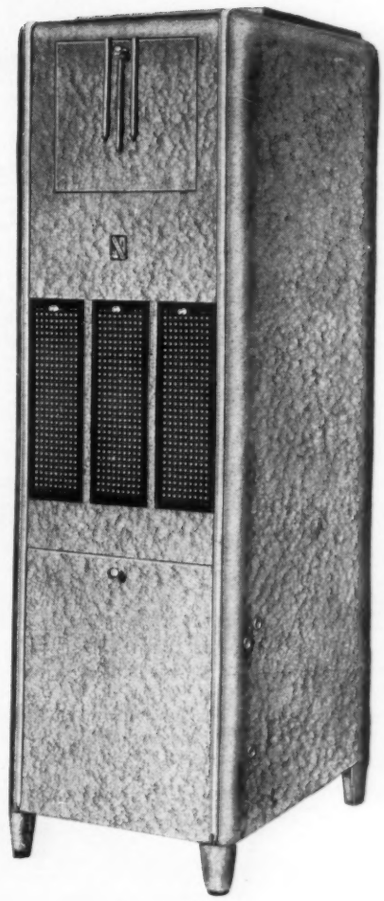
"Now for your information we have an apartment building, next to our store, in which we have stoker heat. This winter we have had gas heat for our store and it has cost much less than the coal bills for the apartment. The apartment is not 25% the area of the store.

"When we open up at 8:00 A.M., we turn the Muelleraires on and in fifteen minutes the store is warm. The electrician who connected them and the engineers for the gas company say they have never worked on a more perfect mechanical device than Muelleraire."

(Signed) Joseph J. Smith.

Be sure to get all facts about the wonderful sales features of Muelleraire. Write for Catalog G-3.

L. J. MUELLER FURNACE CO.
MILWAUKEE, WISCONSIN



THE MUELLERAIRE

—is installed within the space to be heated. It heats, filters and humidifies the air and distributes it by forced circulation. Units shipped completely assembled ready for connection. Casings finished in green crinkle lacquer with chromium trim. Four sizes: A. G. A. output ratings from 72,000 to 180,000 b. t. u. per hour.

MUELLER-MILWAUKEE

The Main Arena of the Municipal Auditorium in Kansas City, scene of the A. G. A.'s Natural Gas Department Convention, May 10 to 14.

Plan Natural Gas Meeting Program; 51 Manufacturers to Participate

By CHAS. D. GREASON

Chairman, Publicity Committee
Natural Gas Department Convention

A LARGE number of manufacturers already have reserved exhibit space for the exhibition of gas equipment and appliances to be held in connection with the convention of the Natural Gas Department of the American Gas Association in Kansas City May 10 to 14. On February 19 a total of fifty-one manufacturers had reserved space, according to an announcement of W. T. Rasch, president of the Association of Gas Appliance and Equipment Manufacturers. It will be the first exhibit held in connection with the Natural Gas Department meeting since the 1929 exhibit which was held in Kansas City.

A home run with the bases full! That is what members of the program committee arranging the Convention have scored. The star batter who has been obtained to really wind up this year's big meeting with a victory is none other than that widely known radio personality—the Mystery Chef.

After arranging what they believe will turn out to be one of the most interesting natural gas programs ever held—with timely topics of interest to all men decided on and with speakers selected for their knowledge of the subjects assigned, the program committee sought to learn if the Mystery Chef could appear on the final general session program, Friday, May 14. They felt that his appearance would bring this year's meeting to a successful climax.

The word from New York, where the "Gas Range Artist" gives his own recipes and food discussions over the National Broadcasting Company coast-to-coast network twice each week, was: "Certainly, I'll be glad to come to Kansas City and appear on the program."

The Chef will discuss the gas industry as he, an "outsider," sees it. He will tell the gas men in attendance what he believes regarding the future of the industry. The Mystery Chef not only has a reputation as a broadcaster but he is considered an excellent extemporaneous speaker.

The Program Committee has scored again, for members have arranged to have Barbara Jenkins, 6-year-old cooking demonstrator from Denver, Colo., appear on the same program with the Mystery Chef. Barbara will prepare food on gas ranges.

Barbara's reputation as a demonstrator has been spreading throughout the country since she started her appearance in public more than two years ago. However, only a few gas men in the Middle West have had the opportunity of seeing and hearing this child wonder. Her only appearance before gas men was in February when she gave her demonstration before sales executives attending the Mid-West Regional Gas Sales Conference.

■ ■

Utility in Mail Campaign

Metropolitan Utilities District, Omaha, Neb., is distributing 30,000 lithographed broadsides featuring the all-gas kitchen as part of its advertising campaign for the year. Each broadside carries a detachable prepaid postcard requesting the cookbook, "Controlled Cooking," thus closely tying in with the national advertising program of the American Gas Association.

Empire Gas & Fuel Conducts Engineering Training School

THE training school for engineering graduates conducted by Empire Gas & Fuel Co., Bartlesville, Okla., was recently re-opened after a lapse of five years, according to Clay Briggs, chief engineer. Enrollment in the current class was limited to qualified men already in the company employ. While no definite plans have been made as to the future operation of the school, the original policy of considering recent graduates from approved engineering schools will probably be resumed.

Briefly, the requisite for consideration is that the applicant must hold a degree in some branch of engineering or in petroleum geology. Selections for the school are made on a strictly competitive basis, and take into consideration scholastic record and the opinions of college instructors and former employers. The men thus tentatively chosen are requested to report to the general office where they are personally interviewed by approximately 15 company executives. The final selection is based on the concensus of these interviewers.

The actual training period covers a maximum of two years, the students receiving assignments of varying length in all major divisions of the company. On these assignments the student works with the regular employees and performs such work as may be assigned by the supervisors. He is encouraged to read trade publications and technical books, and to discuss the operations with the foremen and other qualified employees with whom he comes in contact. Upon completion of each assignment, he is required to submit a report, which is constructively criticized by a competent employee of the department in question. These assignments, being of brief duration, are designed only for the purpose of giving the men the general basic training in all phases of the oil and gas business. Upon completion of the training, the student is assigned permanently to the type of work for which he seems to be best fitted.

■ ■

Brooklyn Union Demonstrates Ranges for Employees

As part of its employee sales plan, The Brooklyn Union Gas Co., Brooklyn, N. Y., is giving approximately 130 modern gas range demonstrations before small groups of staff members.

Such advantages of automatic gas cooking as speed, flexibility, cleanliness, and even distribution of heat of the modern ranges will be set forth by the Home Service staff in co-operation with Donald Johnstone of the Cribben and Sexton Co., manufacturers of the Universal range.

Each demonstration will last 30 minutes. Not more than 30 persons will be booked for a showing. Food will be prepared each time.

■ ■

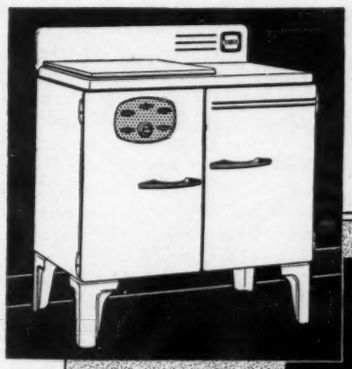
Worthington Takes Over Co.

The Worthington Co., Inc., with offices in Seattle, San Francisco, Los Angeles and El Paso, has been absorbed by its parent organization, Worthington Pump and Machinery Corp., of Harrison, N. J.

ROPER

invites your comparisons

of a line that includes a modern gas range to suit every purse and purpose, from the amazingly complete "Cadet" to the smartly styled, extra capacity "Windsor", and all those in between. "Insta-Matic" clock for FULL AUTOMATIC control of time and temperature in baking operations, available for most models.



With these 6 fine range features:

COUNTER-BALANCED LIFT COVER • ENAMELED DRIP TRAY • LARGE, INSULATED OVEN • ACCURATE OVEN HEAT CONTROL • ROLL-OUT BROILER • AMPLE STORAGE SPACE

and these that are **ROPER'S** *own!*

Lifetime Cooking Chart: Permanently built in. • *"Insta-Flame"* Lighter: Instantaneous action. • Giant High-Speed Burner: Fast and economical. • *"Multi-Flame"* Burners: Exact control of heat. • *"Air-Stream"* Cooking top: One piece, easily cleaned. • Simplified *"Low Temperature"* Oven Burners: Better oven cooking ... Oven canning.

America's Finest Gas Range for over 52 years

THESE RANGES have been built conscientiously and carefully. Every one in the **ROPER** line lives up to **ROPER** standards of gas range perfection. More than fifty years of adherence to these standards will justify the **ROPER,** America's finest, in any comparison that can be made.

Gas is cheaper, faster, better

Complete Advertising and Sales Promotion Helps and Service yours for the asking ... Let us show you

Tie in with the ROPER National Advertising Program

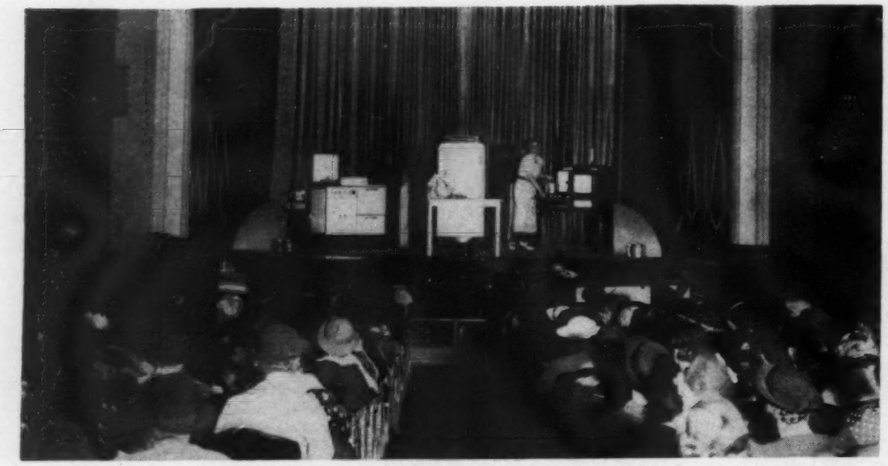
Roper Ranges are ideal for use with any type of gas, including bottled gas.

GEO. D. ROPER CORP.

General Offices and Plant, Rockford, Ill.

WAREHOUSES

San Francisco	Kansas City	Cleveland
Los Angeles	Chicago	Newark
Dallas	Atlanta	Philadelphia



Old and new cooking methods were contrasted at a recent cooking school conducted by the Consumers Power Co., Jackson, Mich.

Old Ranges Give Way To New In Novel Consumers Power Cooking School

OLD cooking methods on old gas ranges were contrasted with new cooking methods on new gas ranges in two-day cooking schools conducted by the Flint division of the Consumers Power Co., Jackson, Mich., as part of the company's Golden Anniversary celebration.

The schools were held at Lapeer and Fenton. Theaters were used, and the audiences expressed appreciation of the comfortable seating arrangement and the full view afforded of the stage.

Part of the demonstration consisted of the cooking of vegetables in the old way—in a large kettle of water, and in the new way—in a small stew pan for waterless cooking. Old and new methods of canning and of cooking meats were also demonstrated.

Advantages of the new ranges with controlled heat were brought home with humor when, during the cake-baking demonstration of old and new methods, a worried member of the audience frequently reminded the demonstrator to look at the cake in the oven of the old-fashioned gas range.

Two new ranges were on the stage for the second day of the school. Oven, surface, and broiler dinners were prepared.

Salesmen have reported that use of the old ranges with the new during the demonstration work is of definite sales advantage. Women carry away from this type of school, they say, an unforgetable picture of the limitations of the old stoves as well as the possibilities of the new.

Plans Formulated for 1937 Electrolux Sales Contest

PLANS for the 1937 Servel Electrolux refrigerator selling contest sponsored by the American Gas Association Refrigeration committee were adopted by the committee at its first meeting, held at the Palmer House in Chicago on January 22, it was announced by Hall M. Henry, chairman. Mr. Henry is assistant to the vice-president of the Utility Management Corp., New York City.

This year's drive will last five months. The intensive period of the contest will be the months of April, May and June. This month, a "warm-up" campaign will be conducted by the committee, and a final selling drive in July will be called a Clean-up Campaign, Mr. Henry announced.

The current campaign will be known as the Tenth Anniversary Campaign. The awards to company contestants will be picturesque and novel, following the policy of previous contests.

It is the aim of the present committee to enlist more than 12,000,000 meters in the campaign, allotted to companies in the special division, as in former campaigns. A special section will be devoted to combination companies.

Members of the 1937 committee, other than Chairman Henry, are: Ben H. Gardner, Gas and Electric Appliance Co., Columbus, Ohio, 1936 committee chairman; Albert G. Schroeder, Grand Rapids Gas Light Co.; Henry Dropp, Milwaukee Gas Light Co.; Paul J. Naschold, New Haven Gas Light Co.; Clyde Potter, Southern Counties Gas Co.; B. O. Brown, Servel, Inc. J. W. West, Jr., secretary of the Commercial Section, American Gas Association, is also secretary of the Refrigeration committee. Howarth S. Boyle, promotion manager of Servel, is collaborating with the committee.

■ ■

March 10 Set for Southern Sales Council Meeting

Postponed for a month, the annual convention of the Southern Gas Association and the Southern-Southwestern Regional Gas Sales Conference is scheduled to meet March 10-12 in Memphis, Tenn. The convention dates were originally February 10-12. The program will be unchanged.

So. Calif. Gas Co. Opens New Office in Glendale, Calif.

NEW district distribution headquarters have been opened by Southern California Gas Co. in Glendale for the Glendale, Burbank, Montrose, and Tujunga districts of this Los Angeles company, and work has been started on a $3300 branch office building in Hemet.

In Glendale, operating headquarters and the car storage and repair building front the street. To the rear is the metering and regulating station. The one-story buildings, covering 6400 sq. ft. each, are of reinforced concrete and brick construction.

General offices and the orifice meter gauge and pressure control board are in the front of the operating building. In this building also are the storeroom, service department, and headquarters for dispatchers and terminal operators.

The metering and regulating station can handle 50,000,000 cu. ft. of gas daily. Part of the natural gas from Kettleman Hills is metered and regulated here for transmission to Los Angeles and the Glendale area.

A recently developed gas floodlight of 1000 candle power is used for yard illumination.

■ ■

Portland Gas. Co. Shows Revenue Increases

Two per cent improvement in operating revenue in 1936 over 1935 enabled Portland Gas & Coke Co., Portland, Ore., to pay dividends of $1.25 a share on the 7 per cent preferred stock and $1.07 a share on the 6 per cent stock. Revenues for the year were up $74,857, and operating expenses were down $51,831.

Increased sale of gas and by-products were responsible for the improved financial condition, according to Paul B. McKee, president. In 1936 volume of gas sold was 9 per cent greater than in 1935. In 1936 the company added 1332 customers, bringing the total number served to 82,796. Residential service made the largest gains.

■ ■

Harrisburg Gas Co. Records Top Year in Sales Volume

The Harrisburg Gas Co., Harrisburg, Pa., did a greater volume of retail sales business in 1936 than ever before in its history. Total retail sales for the year amounted to $186,000, or $23,000 more than in 1935, the company's previous high record. Gas sales increased 4.5 per cent.

Employee prospects in 1936 were 31 per cent of the total of merchandise sales.

The company was a first-place winner in the A. G. A. National Gas Range contest. New offices and sales floor stimulated interest in gas appliances, according to the company.

■ ■

New Wells Near McCune, Kan. Forecast Greater Gas Supply

A new gas well is now being drilled by the McCune Fuel Co. northeast of McCune, Kan., and an offset well is to be drilled as soon as the former well is completed.

Last fall several other wells were drilled and a number of old wells reconditioned in the territory northeast and northwest of the city. Most of these are now supplying gas to the town.

WHAT MAKES A WEDGEWOOD GAS RANGE

entirely MODERN ?

BEAUTY? **YES!**
STYLE? **YES!**
FINISH? **YES!**

Model shown: No.1045-CT.....Closed Top, Table Top Model
Model shown: No. 1085-OT.....Open Top, Table Top Model

but ... MORE IMPORTANT THESE 4 *essential* FEATURES

1. Wedgewood's Extra-Low-Temperature Oven (with automatic temperature control)

Low, even heat — automatically controlled —cooks roasts to juicy tenderness . . . saves pounds of meat from shrinkage . . . retains nourishing meat juices. No watching required. Up to 20% saving on gas. Oven lights itself.

2. Wedgewood's Automatic Cooking Clock

Takes full charge of oven roasting . . . turns gas both on and off at any given time. Gives you free hours away from the kitchen.

3. Wedgewood's Speed-Plus-Simmer Burners

Low, gentle simmer flames for waterless or semi-waterless cooking . . . vegetables retain all natural flavor and vitamins. No food shrinkage . . . no boil-overs to watch. Less gas used.

4. Wedgewood's Astogril Broiler

Cooks steaks, chops, etc., without shrinkage. Sears meat both sides at once . . . seals in natural meat juices and flavors. Easy to get at . . . no stooping . . . requires little attention. No smoke in the kitchen . . . no spattering fats.

● Savings on food, flavor and vitamins pay for these features MANY TIMES OVER.

Your customers will want these 4 modern features . . . if you demonstrate all of them. You'll not only sell more ranges . . . you'll make a GREATER PROFIT on each unit.

ONLY WEDGEWOOD HAS ALL 4

PLUS BEAUTY . . . PLUS STYLE . . . PLUS FINISH

SALES SLANTS

A month by month presentation of experiences on the sales front.

Sales Depend on Sales Approach

"I'M PROUD of my job," said a gas appliance salesman of our acquaintance, "because it's a great compliment to any man who succeeds in the selling game."

The men who make the grade must be of a high type. It takes intelligence, ingenuity and perseverance. Those are the things demanded of the selling profession.

Do you doubt it? Remember that most gas appliances are sold to people who are not interested in buying at the moment. In fact, they usually are content with what they have, and will not be interested in buying until they hear your story.

I got my early training as a salesman under a frank, outspoken sales manager. One of his favorite sayings was, "You are going out to sell people who don't want to buy."

To the beginner this might seem discouraging. It did to me at first, but in the end I gave this idea more credit than any other for helping me to adjust myself quickly to the business of selling.

By keeping this thought in mind, I am always on the offensive. I realize that it is up to me to break the sales deadlock, to make my prospect want to buy.

Nine out of ten will tell you "no" when you ask, "Don't you want to buy an automatic gas water heater?" In fact, they will try to avoid you altogether if they think you might lead them to buy.

This brings us to the point that there is only one way to break the deadlock. The opening remarks to a prospect must be about something of vital interest to him and at the same time closely related to the gas appliance you want to sell.

Several times I have taken the prospect other salesmen had given up, and sold them. For that, they have called me a super-salesman. But in the light of the following you can see that I am not.

For example, one of the prospects that other salesmen had given up as hopeless gave me an Electrolux sale. The prospect had read about the gas refrigerator. Her neighbor owned one, and the prospect also had learned about it from this neighbor. She had a vague idea that she might buy one some day.

But the salesman before me who missed out did not stop to consider that, in spite of these things, the prospect did not want to buy then. Apparently he assumed that she did, and that selling her was only a matter of urging her to action.

He was wrong, as his failure showed. My assumption was: "Here's a prospect who does not want to buy now. I must talk along lines of vital interest to her and build up her realization of need today for an Electrolux."

I started talking about food preservation and the seriousness of the need for it in every home. From that, it was only a step to show how Electrolux satisfies that need.

She bought. Why? Because for the first time she saw Electrolux for what it meant to health and happiness in her home. She acted because she suddenly felt the serious need I had developed.

If my record has been good as a salesman, it must be because I realize that in the majority of cases, I'm going out to sell people who don't want to buy.

■ ■

A Manager's Good Word Often Aids the Salesman

THE other day I happened to overhear a salesman as he unburdened a heavy heart to his companion. His conversation ran like this:

"Where I work now, gas appliances are just a part of the business and I'm the only outside salesman in the gas appliance department.

"Since the day I took the job, the boss hasn't said a dozen words to me about how business was going except to 'raise Ned' when the volume wasn't what he thought it ought to be. For instance, last month business was good; the month before it was better than good. But not a word did the boss have to say, and, believe me, it would help a lot to have a word of deserved praise now and then.

"Maybe he is too busy with other departments, but I think it's the wrong attitude. But believe me, he's not too busy to lay it on my sore back when business is not so good, and I got a sound lashing this morning.

"Of course, I know that I must sell to keep my job, but why should the boss dampen my spirits when what I need is a boost? The way I feel right now, I don't care if I never sell another appliance.

"But I'll pull myself out of that after a time because I've been in the selling business a long time and I know its ups and downs. But the five men who tried this job before me were younger and less experienced. They couldn't survive these back lashings.

"I wish there was some way I could let the boss know I'm a human being and would thrive on a word of praise, his help and co-operation now and then.

"Just think! Instead of sitting here 'gassing' with you I would probably be out knocking on doors right now if the boss had said, 'Pat, this month has fallen behind. But if you work just a little harder, call on just a few more people than usual before the month is out, maybe I can say you have done a swell job after all.'"

This may not be a typical case. But, because salesmen are the key to the selling situation, more time and consideration given to them would doubtless show itself in increased volume.

■ ■

Four Out of Five Lookers Are Appliance Buyers

IF A HOUSEWIFE has not already decided to buy when she walks into your store to look at a modern gas range, or any other gas appliance, you can be sure that she is pretty close to it. Yet conservative estimates place the number who fail to buy as high as fifty per cent.

Certainly advertising has done its job when it creates enough interest and desire to cause the housewife to visit the store to see the appliance. Yet between the approval of the appliance and the actual decision to buy, upward of fifty percent of the prospects are lost. While it may not be possible to entirely close this gap through which volume is falling, many gas appliance merchants have proved that it can be reduced substantially.

Only the conscientious floor salesman can fill the gap. When the housewife has shown enough interest to come into the store, she is entitled to an intelligent and honest presentation of the sales story. Upon receiving it, a larger number of customers will buy. By providing your salesmen with all available literature giving the advantages and features of the products they are selling you will enable them to make an effective presentation. But that effectiveness can be enhanced still more, especially in modern gas range selling.

Your salesmen need to know the product as a user knows it—a knowledge they can gain by having the appliance demonstrated to them. Possessed of such a knowledge, the salesman can always remain the master of an interview; his sales presentation will be thorough and convincing; the partial interest the housewife shows by coming into your store will be carried to an intense desire for ownership resulting in a decision to buy in a greater majority of cases.

Periodical cooking demonstrations in your store for the benefit of salesmen will equip them with the knowledge needed to fill in that gap through which these last prospects are falling.

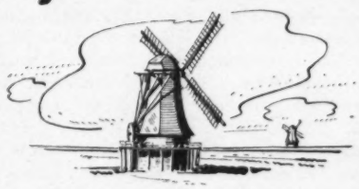
■ ■

Philadelphia Co. on the Air In Cosmopolitan Series

The Philadelphia Gas Works Co., Philadelphia, Pa., is broadcasting three times weekly, rotating the broadcasts in the English, Italian, Polish, and Hebrew languages. Each program lasts fifteen minutes and the series, which began on February 1, will continue for thirteen weeks.

For BAKERS' DUTCH OVENS

AND DIRECT FIRED BAKE OVENS

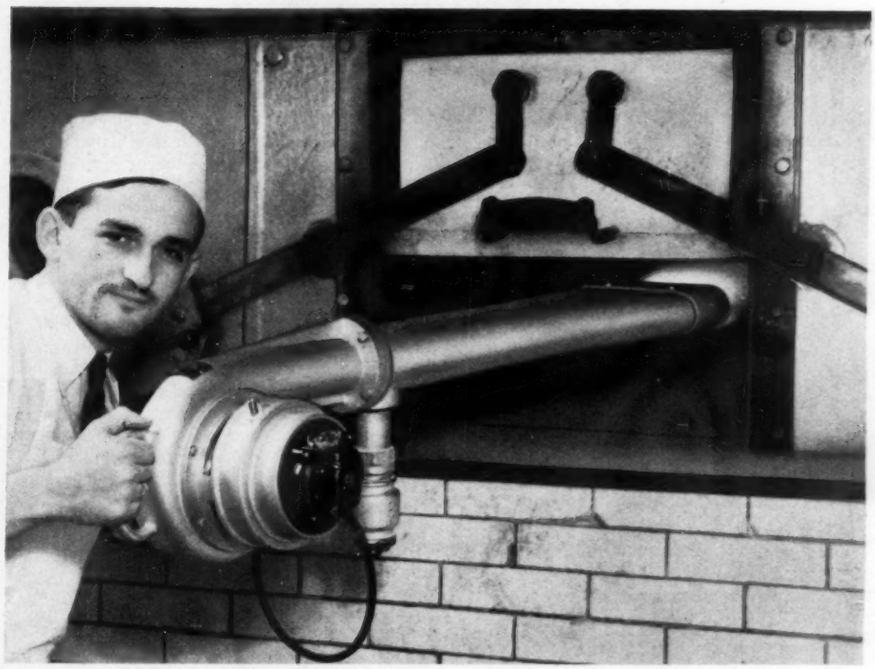


Bakers demand progress. They want perfect baking results, and they want them economically.

Thorough familiarity with bake oven design and operation has helped N.G.E. engineers offer baking progress.

In countless instances, N.G.E.'s "gun like" Type GA Gas Burner is effecting production economies in time, space, fuel and labor.

The Type GA Burner is ideally suited to installation in direct-fired, inside furnace or "Dutch" ovens. Note how it can be swung into firing position. See how it may be pointed to any cold corner of the oven. Note how the proper heat can be "shot in" to achieve perfect baking results.

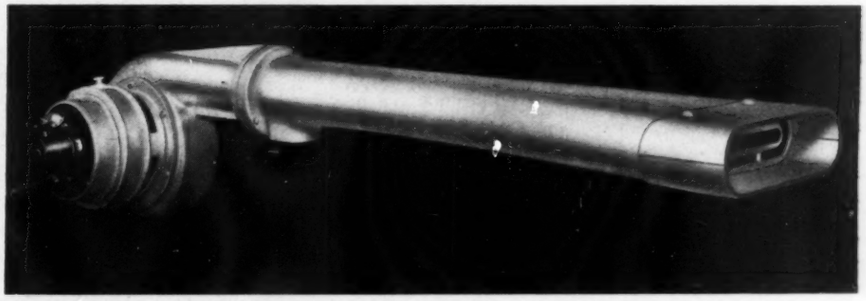


Specify N. G. E. GAS BURNERS

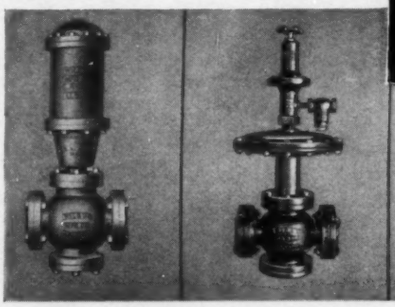
TYPE GA BAKE OVEN BURNERS

The repeated acceptance of N.G.E.'s Type GA Gas Burner reflects its many outstanding operating features. It is easy and safe to light and operate. It affords uniform heat distribution and perfect combustion. Adjustments are simple, a dial gas valve permits exact setting; it has large reserve burner capacity. Quality of production is more uniform, yet fuel costs are measurably reduced.

Write for your copy of a Bulletin completely describing these features. It is complete with specifications and drawings, showing how ideally this type burner may be adapted to your particular requirements.



LOOK TO THE PIONEERS FOR CONTINUED LEADERSHIP



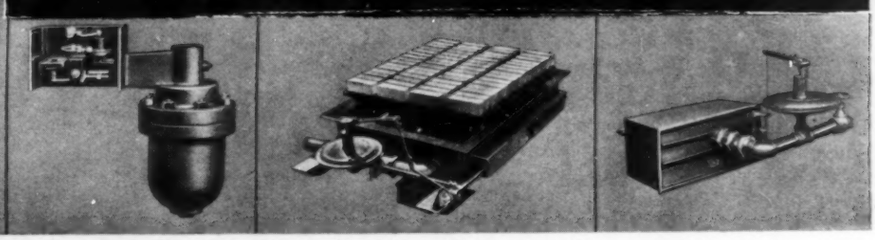
NATURAL GAS EQUIPMENT, INC.

PETROLEUM SECURITIES BLDG.
LOS ANGELES, CALIF.

1123 HARRISON STREET
SAN FRANCISCO, CALIF.

BAKERSFIELD, CALIFORNIA

Natural Gas Equipment Co. of Texas, 811 Sterling Bldg., Houston, Texas



P. G. and E.'s "Tales of California" Broadcast Receives Warm Welcome

By AGNES BARRELL

Staff Correspondent

IN San Francisco, Calif., the Pacific Gas and Electric Co. has been experimenting with a weekly broadcast which has resulted in general satisfaction on the part of its sponsors, according to A. C. Joy, advertising manager of the company. No effort is made to do any direct selling, the commercial "plugs" being devoted to suggestions of gas and electric service and their benefits and conveniences in the modern home.

A. C. JOY

The commercial message carries frequent mentions of gas, and in the awarding of prizes to participants in story contests, the winning contestant is allowed to choose either a gas or an electric appliance.

The broadcast is presented under the title "Tales of California" and is heard on the National Broadcasting Co. station KGO every Sunday night at 7:30 o'clock. The program opens with a brief dedication to a town or city which has Pacific Gas and Electric Co. service, and then moves into dramatized presentation of a true tale of the particular community introduced, in conversations between an old lineman and his youthful helper.

So far there have been stories out of San Francisco, Oakland, Sacramento, Berkeley, Benecia, Stockton, San Jose, Marysville, Monterey, Grass Valley, Napa, San Rafael, and Salinas, with broadcasts scheduled in the immediate future for San Mateo, Santa Rosa, Oakland, Martinez, Modesto.

In order to get the stories a contest is held in each community, with participation limited to residents of the county in which the honored city is located. Newspaper advertisements and counter distribution of informative circulars is used as advance advertising for the contest. Everybody is invited to send in a story. These must be true stories of the community and must have dramatic interest, but do not necessarily have to be tales of community history. They can be tales of adventure, or experiment, or love, or character, or animals.

The stories obtained are submitted to a committee of three local persons, usually chosen from educational circles and study clubs, and in no way connected with the Pacific Gas and Electric Co. The committee is instructed to pick the three best stories submitted. These are sent to the utility's publicity department and are then passed on to Samuel Dixon of the National Broadcasting Co., who makes the final selections.

So far there have been submitted stories dating back to the days of the Spanish occupancy, to the days of '49, to an immediately later period when law and order was maintained by sheriffs who were quick on the trigger, and to more modern days when civic consciousness and pride had become firmly established in virtually every part of the state.

First prizes are: choice of a gas or electric refrigerator, gas or electric range, gas heating appliances, or equal value in appliances up to about $150.

An interesting development has been that the first prize each week has almost always been won by someone in particular need of a certain appliance. Several ancient gas ranges have been replaced with new ones, several automatic gas water heaters have been selected either to replace old fashioned coil heaters or to give a home its first experience with running hot water. Two or three installations of gas heating appliances have been the preferred awards.

A prize is also awarded each week to the writer of the second best story. This is a choice of any gas or electric appliance of list value of $22.50.

There is every indication that interest in this program is steadily increasing. Many fan letters have been received both by the radio station and the Pacific Gas and Electric Co. from persons stating that they listen regularly and enjoy the programs. Another indication of the increasing interest is the steadily growing number of critical letters, which are most numerous when the story brings out some controversial point in an historical incident. In a number of the broadcasts, characters long since dead have been mentioned. It is additional evidence that the programs are being listened to that numerous flattering letters have been received from their descendants.

It is not to be contended that "Tales of California" can compete in radio interest with the great programs coming on the national hook-ups. The program, which is presented solely as an interesting dramatized narration of a true incident, is dignified, offers a cast of trained stage and radio players, and has as its main object the bringing of Pacific Gas and Electric Co. more intimately into the homes of its customers than ever before.

■ ■

Grand Rapids Gas Service Doubles in Past Six Months

Since the final changeover last October from manufactured to natural gas in Grand Rapids, Mich., the Grand Rapids Gas Light Co. has practically doubled the amount of gas served in its territory. The company now serves 47,000 residential and commercial users, having added more than 2400 homes since the introduction of natural fuel. Installations are continuing at the rate of from 25 to 50 a day. About 6,000,000 cu. ft. are used daily.

Approximately 2500 families were heating their homes with gas in January of this year, according to A. G. Schroeder, vice-president and secretary. During 1936 the company installed about 3000 modern gas ranges, and co-operating stores sold about the same number. Gas refrigerators sold numbered nearly 500. More than a thousand automatic gas water heaters were sold by the company alone. Co-operating plumbers sold even a greater number. The company expects to double the number of water-heater installations in 1937.

A ten-inch pipe line brings gas 45 miles from the Millbrook-Belvidere-Hinton field south of Remus. Total cost of the transmission and distribution system was $720,000. Changeover costs on premises amounted to an additional $225,000.

■ ■

Minn. Co. Employee Drive Ends 58% Ahead of Quota

WITH the sale of 7961 major appliances during the employees' sales campaign, March 15 to December 31, 1936, Northern States Power Co., Minneapolis, Minn., closed its nine and a half months' drive 58 per cent ahead of the quota.

The company's 5049 employees turned in 33,769 prospects, an average of 6.69 prospects for each employee. The ratio of sales to prospects was 24 per cent.

The Faribault division of Northern States Power Co. made the highest percentage of quota—353 per cent—of any division. Other divisions made the following quota records:

St. Cloud and Stillwater, 277 per cent; Galena, 265 per cent; Southwestern, 213 per cent; Sioux Falls, 204 per cent; Wisconsin, 180 per cent; Grand Forks, 172 per cent; St. Paul, 137 per cent; Minneapolis, 126 per cent; Minot, 121 per cent; Mankato, 120 per cent; Fargo, 45 per cent.

Employees in the Minneapolis division, with members of their families, celebrated the success of the load-building drive with a Christmas party at the Minneapolis auditorium. Employees in this division sold 2186 major appliances. The party, attended by 5000 persons, was interrupted dramatically by newsboys who rushed into the auditorium shouting, "Extra! Extra!" To every person present they gave a copy of *The Minneapolis Star*, which had devoted its first page to the celebration and the contest, with pictures of the three high men and a list of the 920 employees who made sales.

■ ■

Philadelphia Co. Doubles Sale of House Heaters

Philadelphia Co., Pittsburgh, Pa., more than doubled its house heating appliance sales in 1936, selling (to December 1) 2537 circulating heaters, 266 boilers and furnaces, 676 conversion burners, and 166 unit heaters. These appliances will add an estimated annual load of 473,000,000 cu. ft. and an estimated annual revenue of $215,000.

Employees turned in 50 per cent more prospects for gas heating appliances in 1936 than they did in 1935 and the company attributes its 1936 gas-heater sales record to this co-operation. From September 15 to November 15 employees reported 1673 prospects, from which 577 sales were made.

BUTANE-PROPANE NEWS

Introducing a Supplement to the Handbook of Butane-Propane Gases, Second Edition—To Record Two Years of Progress in Liquefied Petroleum Gas Operations

IN 1931 the publishers of *G A S* perceived the need for a handbook devoted to the specialized needs of the liquefied petroleum gas industry. The first edition of the *Handbook of Butane-Propane Gases* came from the press in 1932, finding rapid acceptance both as a symposium of the young industry's experience to date and of all phases of operating experience.

Developments in the industry following publication of the first edition came thick and fast, and a revised and amplified handbook was clearly necessary. The publishers met this need in 1934 with the second edition, which, like the first, found its way into every country where butane and propane are distributed.

Two years have now elapsed since the publication of the second edition. While liquefied petroleum gas operations have undergone important expansion during this period, there have been few fundamental changes in engineering practices. Decision was therefore reached to delay a basic revision of the handbook in a third edition, and instead to utilize the Butane-Propane News department of *G A S* in this March issue as an "Interim Handbook."

The articles which appear in the following pages will be reprinted in book form, together with certain other material carried in previous issues of this publication, and will comprise a supplement to the second edition of the *Handbook*. All purchasers of the second edition will receive the supplement free of charge.

In taking the plan for an "Interim Handbook" to the industry, the publishers have met with the same ready co-operation extended to the *Handbook* enterprise. Special thanks are again due the Philgas organization. We call particular attention to the "Guest Editorial" by Mr. G. G. Oberfell and to the articles in the following pages by Philgas authors. In this connection the advice and assistance of Mr. Ross W. Thomas, vice-president and general manager of Philgas, is acknowledged with appreciation. To the authors of industrial chapters our special thanks are due. Included in this list are Messrs. W. Z. Friend, G. L. Brennan, R. B. Childs, Emeric Kroch, Ellsworth L. Mills, W. M. Couzens, W. G. Watkins, F. Harry Andrews, H. W. Harts, C. L. Parkhill, and E. E. Tattersfield.

Through the joint efforts of these men, the publishers of *G A S* have been able in this issue of *G A S* to chronicle the highlights of liquefied petroleum gas development, reviewing the significant phases of appliance utilization, distribution operations, central plant development, internal combustion engine usage, and other specialized phases.

Guide to BUTANE-PROPANE FEATURES

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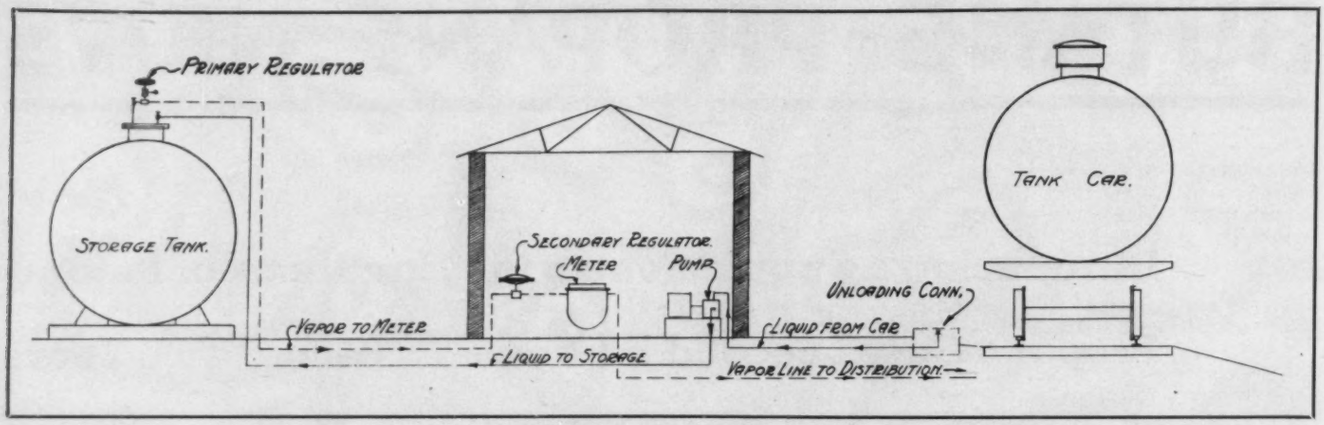


FIG. 1. Flow sheet for undiluted propane plant.

COMBINATION CENTRAL PLANT CAN COMPLETE UTILITY SERVICE AT

THE increasing application of propane and butane in furnishing gas service through distribution mains to towns of 1000 to 10,000 population, in which the investment in water gas or other types of gas manufacturing plants would not be profitable, has called attention to the many other advantages which liquefied petroleum gases offer these municipalities. Among the utility serv-

W. Z. FRIEND

G. L. BRENNAN

ices which can in many cases be furnished more efficiently with propane than with any other fuel, are the following:

1. To supply undiluted propane or propane-air gas service through gas mains and distributing lines to the town.

2. As fuel for internal combustion engines, direct-connected to generators for generating the town's light and power requirements.

3. As fuel for internal combustion engines direct-connected to centrifugal water pumps and in some cases to sewage pumps and for other pumping requirements of the town.

4. Expansion of the liquid propane to a gas for the above and other applications. furnishes refrigeration for a portion of the town's ice and cold storage requirements.

5. As fuel for gas-engine driven compressors, to furnish the town's requirements of refrigeration, ice manufacturing and cold storage, above that quantity furnished by evaporation of propane as in item 4.

6. Propane can be used as the refrigerant itself in the refrigeration compressor, in place of the ammonia customarily used. This is accomplished by recondensing and re-evaporating a portion of the propane already vaporized.

A combined plant such as described here can be installed in one location and the internal combustion engine units can be so interconnected with the driven units that they operate either one utility or another. Operation of the engines is thus kept at a high load factor. Investment in prime movers for such a combination plant would be at an absolute minimum, very materially less than in past practice, where the various utilities of the town are located and operated separately, and must each have sufficient prime mover installations to take care of its own peak load and space requirements. A number of the advantages of such a combined utility plant are enumerated:

1. The investment in such a plant would be less than in separate plants furnishing separate utilities, thus providing lower fixed charges, with consequent lower unit cost for each service than in most small municipalities today.

2. Because the plant would be centralized in one location, labor and supervision costs would be very low.

3. The peak loads of gas and electric requirements come in the winter while those of the ice and cold storage and water-pumping plants come in the summer, enabling the prime movers to operate at high load during the entire year, with consequent attainment of high efficiency.

4. A large portion of the investment for utilization of liquefied petroleum gases is in storage tanks, vaporizers and pressure regulating equipment, and is very little more than would be required for a separate gas plant, power plant, or refrigeration plant, using liquefied petroleum gases.

5. Such a combined plant would, whether privately or municipally operated, offer an extraordinary opportunity for the furnishing of all these utility services at a cost lower than would be the case where the users must purchase each service from a different supplier. supplier.

6. Propane itself is a refrigerant, in that it is stored in liquid form and must be vaporized before distribution as gas or before utilization in internal combustion engines. The supply of latent heat for this vaporization will furnish a portion of the town's refrigeration requirements at no cost at all, since the vaporization must be accomplished anyway.

7. The liquefied petroleum gases are highly efficient fuels for internal combustion engines, having high anti-knock values and giving excellent efficiencies in such utilization.

Gas Plants for Small Cities

Over 130 communities in the United States are today being served with gas from central plants utilizing butane or propane, or mixtures of the two. The service being rendered is either a gas-air mixture of approximately 530 B.t.u. per cu. ft. or undiluted gas, ranging from 2500 B.t.u. to 3200 B.t.u. per cu. ft., depending upon the liquefied petroleum gas used. A recent survey of towns without gas shows that there are nearly 2000 communities between 1000 and 2500 population, and approximately 400 over 2500 without gas service. The total gas required for any of these communities is small. The load factor is very apt to be extremely low, hence supplying these towns with gas through transmission lines from other cities is often economically quite out of the question, inasmuch as the fixed charges are prohibitive.

Undiluted Propane Plants

There are a number of undiluted propane plants in successful operation at the present time, among them being those at Wahpeton, N. D.; Detroit Lakes, Minn.; Wisconsin

By W. Z. FRIEND
and
G. L. BRENNAN
Philgas Department
Phillips Petroleum Company

FURNISH LOW COST

Rapids, Wis.; Snow Hill, Md.; St. Vital (Winnipeg) Manitoba; Chincoteague Island, Va.; Belvidere, N. J., and numerous others on the Pacific Coast. One of the outstanding advantages of an undiluted propane plant is the simplicity and low cost of the equipment required. This equipment is composed essentially of the following: (1) unloading pump; (2) propane storage tank and accessories, of 200 lb. working pressure; (3) two stages of gas regulation; (4) station meter; (5) housing for pump, second stage regulator and meter; and (6) plant site and railroad siding.

Recent estimates show the above described type of plant can be completely installed for approximately $7500.00. This figure does not take into consideration the cost of a distribution system. The figures computed below show a break-down of these costs.

Plant site	$ 500.00*
Railroad siding	1500.00*
Fence	600.00
Shelter	75.00
15,000 gallon storage tank, pump, regulators and meter, valves and piping	4000.00
Construction, labor and supervision—freight	1000.00
TOTAL	$7675.00

The equipment as described is capable of serving at least 500 meters under the average load conditions, and with slight additional cost, could easily handle a domestic load of 1000 customers. It is interesting to note that with 500 customers being served, the plant investment cost will be approximately $15.00 per meter, and will be less than $10.00 per meter with 750 customers. This low plant investment makes this type of plant very attractive to gas utility companies planning to serve new territories. Fig. 1 illustrates a typical undiluted propane plant.

The undiluted propane plant is most suitable for communities in which new distribution systems are installed, or where the older systems are of such construction that low unaccounted for losses may be assured. In many of the present undiluted propane plants the gas is vaporized in the storage tank, passed through two stages of gas regulation, and then into the distribution system. However, in the case of a combined utility plant, the propane is vaporized in a brine circulating heat exchanger, so that the refrigeration effect of the vaporization can be utilized. The labor required at the gas plant itself is only for unloading tank cars of fuel, inspecting the equipment, and taking meter readings. No high pressure gas storage tanks or compressors are necessary, and a high quality gaseous fuel of constant thermal value and specific gravity is automatically distributed.

In heating value 5.78 gallons of propane are equivalent to 1000 cu. ft. of 530 B.t.u. gas. On the basis of propane delivered at $0.06 per gallon, the cost per M of gas in the mains, on the basis of 530 B.t.u. equivalent, would be $0.347 per M. For each gallon of propane vaporized, there is required 650 B.t.u. for latent heat of vaporization, assuming that the liquid propane is delivered to the heat exchanger at 60°F.

An undiluted propane plant serving approximately 500 meters would normally use about 195 gallons of propane per day, requiring a latent heat of approximately 140,000 B.t.u. per day, which can be used for refrigeration purposes, if such a gas plant is combined with a refrigeration plant.

Butane-Air or Propane-Air Plants

In the event a carbureted water-gas or coal gas plant is to be replaced and liquefied petroleum gas used as the main fuel supply, then the use of a gas-air mixture frequently will be found to be more desirable than the distribution of an undiluted, higher thermal value gas. It may be impossible to change the basis of rate making, or, because of high unaccounted for distribution losses, a low thermal value gas may be desirable. The investment required for this type plant is somewhat greater than for an undiluted propane plant, though when older operations are to be discontinued, it is frequently found that a considerable amount of equipment used in the former plant can be adapted to the new type of gas-making operation, thereby keeping the new plant investment at a low figure. Fig. 2 is a flow sheet of a typical propane-air or butane-air plant.

Butane, with its somewhat higher thermal value, at first glance would appear to be a more economical fuel to use for small town distribution, but there are added costs imposed by the preparation of the gas-air mixture which in some cases mean that butane-air gas will deliver into the mains at a figure higher than that shown for undiluted propane plants.

*Plant sites are frequently available with suitable siding in place, resulting in a reduction in cost.

NOTE: In the case of combined utilities, the plant itself would have to be somewhat larger, with investment in excess of the above being charged to the other utilities.

TABLE NO. 1. INVESTMENT, PLANT OPERATING COSTS AND ESTIMATED GROSS INCOME, LIQUEFIED PETROLEUM GAS PLANTS

	500 Meters			1000 Meters		
	Undiluted Propane	Butane-Air	Propane-Air	Undiluted Propane	Butane-Air	Propane-Air
Plant Investment	$ 7,000.00	$14,500.00	$15,500.00	$ 7,500.00	$15,000.00	$16,500.00
Distribution Investment	35,000.00	40,000.00	40,000.00	65,000.00	75,000.00	75,000.00
Total	42,000.00	54,500.00	55,500.00	72,500.00	90,000.00	91,500.00
TOTAL Investment per meter	$ 84.00	$ 109.00	$ 111.00	$ 72.50	$ 90.00	$ 91.50
Delivered Fuel Cost, per gallon	6.00c	6.00c	6.00c	5.75c	5.75c	5.75c
Gallons per M c.f. 530 B.t.u. Gas*	5.78	5.17	5.78	5.78	5.17	5.78
Fuel Cost per M c.f. 530 B.t.u.	34.7	31.0	34.7	33.2	29.7	33.2
Power, Labor, Heating, etc.	5.0	18.0	18.0	2.5	12.0	12.0
Cost per M c.f. in Mains	39.7 c	49.0 c	52.7 c	35.7 c	41.7 c	45.2 c
Av. Consumption per Meter per Mo. cu. ft.	2000	2000	2000	2500†	2500	2500
Av. Rate per M c.f.	$ 1.80	$ 1.80	$ 1.80	$ 1.60	$ 1.60	$ 1.60
Monthly Revenue per Meter	$ 3.60	$ 3.60	$ 3.60	$ 4.00	$ 4.00	$ 4.00
Gross Revenue per Yr.	$21,600.00	$21,600.00	$21,600.00	$48,000.00	$48,000.00	$48,000.00

*All costs, rates and consumption on basis of 530 B.t.u. gas.
†A.G.A. data show monthly consumption increases as gas rate becomes lower.

TABLE NO. 2. COMPARATIVE TEST RESULTS

Obtained at Full Throttle with Propane, Butane and Gasoline on 6-Cylinder, 4 by 5-in. Engine

Fuel	Compression Ratio	Corr. Max. h.p.	Average Specific Fuel Consumption (Actual Test Data)		Per Cent Increase in Bhp. Over Gasoline at 4.38 C.R.	Per Cent Decrease in Specific Fuel Consumption, lb. basis	B.t.u. Basis Per Cent	Octane No.
			Lb. Fuel per Bhp.-hr.	B.t.u. per Bhp.-hr.				
Propane	9.95	99.0	0.458	9,920	56.2	30.9	26.6	125
Butane	5.75	86.8	0.512	11,000	37.0	22.80	18.6	93
Gasoline	4.38	63.4	0.663	13,517	.....	.....	.....	61

TABLE NO. 3

Average Cost of Gas Engines F.O.B. Manufacturer's Plant*

Capacity			Dollar Cost Per	
hp.	kw.	Speed—r.p.m.	h.p.	kw.
240	180	900	20-25	27-34
500	375	275-300	38-40	51-54
750	550	275-300	36-38	48-51
1000	750	225	33-36	44-48
1350	1000	225	30-35	40-47

Electric Generator Equipment Costs F.O.B. Manufacturer's Plant†

Capacity	Dollar Costs per kw. at Various Speeds			
kw.	900 r.p.m.	450	360	277
200	18-25	23-28	25-30	
250		17-20	21-25	25-30
500		14-18	15-20	17-25
750		10-14	12-16	14-18
1000		9-12	11-14	24-15

*Costs do not include freight, foundations or erection costs.
†Based on 60-cycle, 3-phase, 2200-volt circuit, including exciters, control and switchboard equipment. Costs will vary according to engine connections and multiplicity of control and switchboard equipment required.

Such items as labor, power, heating and maintenance are all higher, so that from $0.10 to $0.20 per M must be added to the actual delivery fuel cost to determine the final production cost.

The use of propane-air gas in many plants has distinct advantages, inasmuch as dew points in high pressure storage tanks present no problem such as are encountered during the winter months when butane-air gas is subjected to high storage pressure, and low temperature.

In a recently installed butane-air plant, which replaced carbureted water gas operation with an existing low pressure water sealed gas holder, the cost of converting the plant to butane-air operation was approximately $5,000.00 and very substantial savings over manufactured gas costs have been realized.

Table No. 1 gives pertinent information on undiluted propane, propane-air and butane-air plant operation, with particular reference to plant operating costs, investment requirements and gross revenue possible for various sized properties. Local conditions, gas rates, type of management and condition and age of the distribution system affect the operating costs outside of the plant, so that the presentation of these costs is not attempted, but the figures showing the spread of the net operating cost and gross income are of distinct interest.

Electric Power Generation With Internal Combustion Engines

The last few years have seen a very remarkable increase in the use of liquefied petroleum gases as fuels for internal combustion engines. These gases are being used as fuels for large stationary engines direct-connected to generators by many public utility companies and oil companies for sources of regular power, for boosters, or for stand-by use in conjunction with regularly used steam generating systems. In several cases gas engines, formerly fueled with producer gas, are being used for this stand-by service, which in addition to providing savings in fuel and labor costs, results in an investment in engines for this work which is considerably less than that possible to obtain with almost any other type of prime mover. A gasoline pipe line system uses butane gas fueled engines directly connected through step-up gears to high-speed, high-pressure centrifugal pumps. These fuels are also used for operating generating equipment, gas compressors, sewage disposal plants and in block-testing or running in of automotive engines.

Liquefied petroleum gases, butane and propane, have very high anti-knock ratings; the octane number of propane is well over 100 and of butane approximately 93, both greatly in excess of the finest grades of motor fuel now available. The high anti-knock characteristics of these fuels permit the use of high compression ratios, resulting in increased thermal efficiency and power output, and in decreased specific fuel consumption.

The data shown in Table No. 2 and Fig. 3, were obtained in a comprehensive series of dynamometer tests on a well known make of stationary engine, comparing propane, butane and gasoline as fuels.

Another advantage of liquefied petroleum gases over liquid fuels is in the completely gaseous form in which they are fed to the carburetor, or gas-air mixer, resulting in thorough mixing of fuel and air and uniform distribution of the gas-air mixture to the engine cylinders.

A summary of advantages of propane and butane for internal combustion engine operation follows: (See Table No. 2). (1) high thermal efficiency, (2) low specific fuel consumption, (3) practical absence of obnoxious exhaust odors, (4) high power-weight ratio,

(Continued on Page 78)

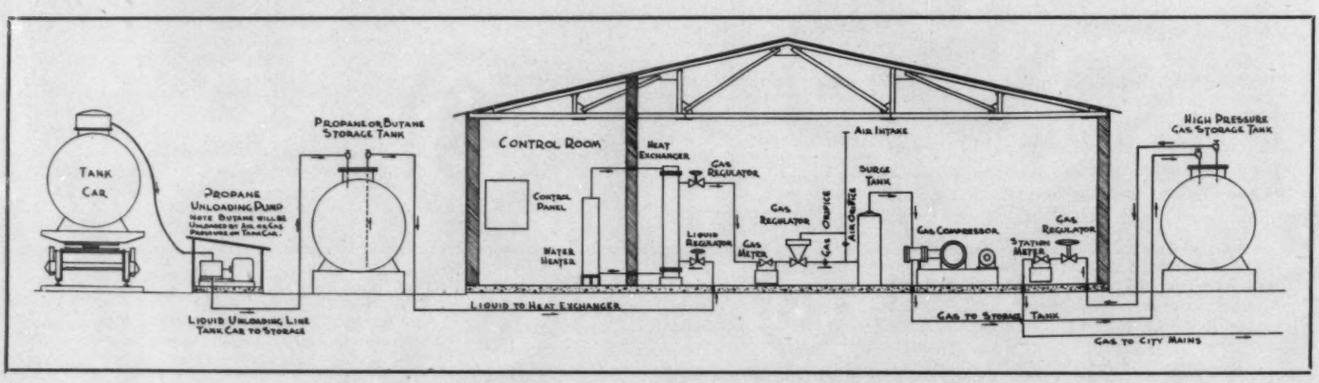


FIG. 2. Propane air plant or butane air plant flow diagram.

Panorama of Spokane United Railway's bus garages and fueling yard, looking south from Boone Avenue.

BUTANE USE IN BUSSES

Economies and Improved Service Follow Installation in Spokane

By R. B. CHILDS

Assistant General Manager
Spokane United Railways

THERE is nothing new or startling in use of liquefied petroleum gases as a fuel for internal combustion engines. The use of a butane-propane mixture by the Spokane United Railways as a fuel in lieu of gasoline for all of its busses is distinctly new and unique. The Spokane operation, which includes bulk storage and dispensing facilities in addition to the facilities on the busses themselves, is the only one in the country at the present time to make use of this particular fuel on all of its equipment. The reasons for the substitution of butane for gasoline, the facilities which were installed to make the change effective, and the results which have been achieved to date by such changes, are of particular interest in that neither precedent nor previous experience was available in the solutions which were found for the many problems incident to the application of this particular type of fuel. Because of their relation to many of the problems incident to the change-over, it will be of value to consider first the physical facts surrounding the Spokane United Railway's operations prior to December, 1934.

R. B. CHILDS

The City of Spokane, in eastern Washington, has a population of approximately 125,000 and covers an area of 41 square miles. The Spokane River divides the city into two approximately equal sections—the north half being virtually level while the south section is quite hilly, rising from the central part of the city in successive benches. The climate is a distinctly seasonal one with variations from a maximum of 105°F. in the summer to a low of —20°F. in the winter, and an annual rainfall of 16 inches. Prior to 1931 the company supplied transportation service within the city limits with an electric street car system. The lines on the north side of the river had few grades, but those on the south side had grades up to a maximum of 12 per cent. Late in 1931 the company substituted gasoline driven busses on two of its street railway lines and since that date has with each succeeding year converted more and more of its lines from electric operation to gasoline bus operation. As of today, there are no electric street cars in operation and a total fleet of 130 busses handles the transportation inside the city limits.

In 1934 the following advantages of using butane instead of gasoline were held out as being of sufficient value to warrant making the change: decreased engine maintenance costs, decreased oil consumption, improved fuel economy, smoother operation and elimination of obnoxious exhaust fumes. Late in the year, 10 busses were changed from gasoline operation to operation with a fuel which was approximately 65 per cent butane and 35 per cent propane. This was done as an experiment in order to determine whether the advantages claimed for the new type of fuel were of sufficient value to warrant the investment in the necessary storage and dispensing equipment, and the further expense of converting the busses themselves for butane operation. The success of this initial installation from an operating standpoint was sufficient to warrant the decision to proceed with the conversion of the remaining busses in the fleet, and the installation of facilities for an ultimate 100 per cent use of butane. The conversion has actually taken many months due to the difficulty of taking equipment out of service for the time required to make the necessary changes, hence no accurate comparable figures are as yet obtainable which would indicate total fleet costs for 12 months' operation with butane as against 12 months' operation with gasoline. However, the present trend indicates the wisdom of the original decision, and justifies the capital expenditures.

It was apparent very early in the conversion from gasoline to butane that there were two major problems involved—one that of providing proper storage and dispensing facilities, and the other the installation on the busses themselves of the necessary storage tanks, carbureters, etc. Considering the first problem, that of storing and dispensing, it was decided to purchase the fuel in tank car lots from the refinery and provide sufficient bulk storage in Spokane for at least two weeks' operation. At the present time, the total use of fuel by the entire fleet is on the order of 100,000 gallons per month and considering the distance to the refinery and the possible delays in shipment of carload lots due to inclement weather in the winter, a storage of 75,000 gallons in Spokane was considered sufficient. As shown in Fig. 1, the storage yard contains two tanks with a capacity of 12,500 gallons each and two tanks with a capacity of 25,000 gallons each. The two sets of tanks are separated by 100 feet. Tank cars are spotted on the spur track midway between the storage tanks, and the fuel pumped directly from the tank car to whichever tank it is desired to fill. A vapor recompressor unit to as-

sist in tank car unloading is mounted on the unloading platform.

As shown in Fig. 2, multi-stage centrifugal pumps are used for transferring liquid fuel from tank cars to storage tanks and from one storage tank to another. These pumps are also used for fueling the busses as described below. Because the pumps, valves and other mechanisms were not carried in stock locally, and because from an operating standpoint it was of prime importance that routine transportation service supplied by the company be not delayed or interfered with by a possible breaking down of fuel supply and periodic delivery of fuel to the busses themselves, it was decided to provide duplicate equipment as far as possible. For these reasons, there are four Byron Jackson pumps, one for each of the large storage tanks but they are so interconnected that either pump can pump into or pump out of either of the 12,500 gallon tanks and similarly either pump can pump into or pump out of the 25,000 gallon tanks. Liquid fuel can also be transferred between either of the smaller storage tanks and either of the larger tanks.

All of the four storage tanks are equipped with Shand & Jurs liquid level gauges together with pressure gauges and thermometers. The inputs to or withdrawals from the main storage tanks during tank car unloading are not metered but are calculated in terms of standard gallons from the corresponding gauge readings, vapor pressure readings and liquid temperatures. At the outset, it was decided to follow rigidly the specifications as laid down by the State of California Industrial Accident Commission, more particularly as set forth in its orders dated March 12, 1934. When the first tank and dispensing installation was made in 1934, the railway system was only partially motorized and it was rather difficult to install the main storage tanks, piping, etc., in compliance with these orders insofar as maintaining the prescribed distances from adjoining buildings was concerned. As more and more bus lines were substituted for electric street car lines and some of the old street car barns were dismantled, sufficient room was provided for the installation of the remaining storage equipment with the final location as shown by the general layout plan.

There were two reasons for separating the two groups of storage tanks and for placing the dispensing equipment on opposite sides of the yard. First, to preclude if possible involving both dispensing stations in the event of fire or trouble at either one; and second, to locate the fueling spots with some reference to routine fueling and storing the equipment at night in the garages. Only one new garage was built. The former street car barns were converted into garages for a relatively small capital outlay, and minor changes made in the rest of the old buildings to provide for machine shop, paint shop and body and fender shop.

It is very probable that if the installation could have been started from scratch and all designed and constructed as one unit, a better scheme could have been devised particularly with reference to tank car unloading, bus fueling, routine bus inspection and maintenance, and garage location. However, the installation as it now exists complies with the requirements as laid down by the California Safety Orders, and from the standpoint of the operation of the transportation system as a whole it is not without its good points.

Steam Coil Installation

With the range of temperatures existing in Spokane, some concern was felt originally about the possibility of vapor pressures in the main storage tanks falling to extremely low values during periods of sub-zero weather. With the thought in mind of keeping the vapor pressures up during such weather conditions, steam coils were installed in the inside of the skirt at the base of each tank, the coils lying flat against the outer surface of the ellipsoidal head of the bottom of the tank. An actual test during cold weather demonstrated that the temperature of the liquid in the tank and the corresponding vapor pressures could be raised somewhat by admitting live steam into the coils, but during the two winters which have been experienced so far, there has been no need to use this method of keeping the vapor pressure up to the point where fuel could be transferred from storage tanks to the bus fuel tanks.

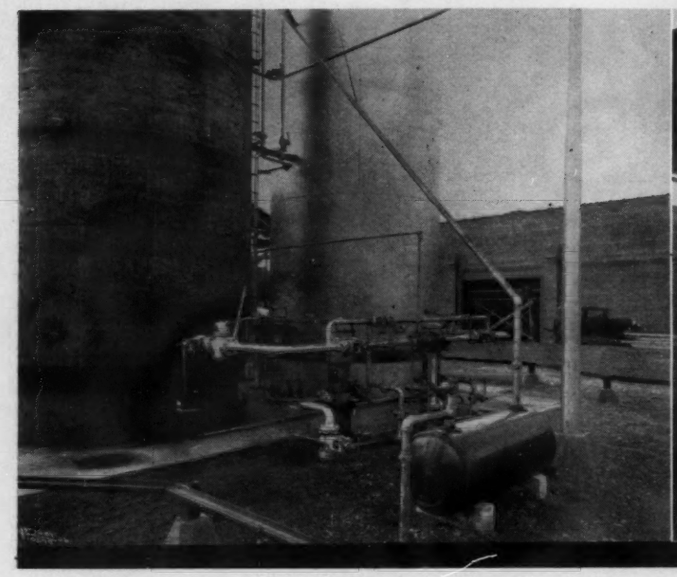
The original installation had barely been completed and put into operation early in January, 1935, when a sudden cold wave visited the Spokane area. After approximately a week of air temperatures varying from 16° F. to 26° F., there was a very rapid drop in temperature, reaching a low point of —18° F. at the end of the third day. Readings taken at the time of the —18° F. air temperature showed that the temperature of the fuel inside the main storage tanks was —5°F. and the corresponding gauge vapor pressure was 20 lb. to the square inch. A somewhat similar range of temperatures was experienced during February, 1936, with practically the same fuel temperatures and pressures. These two experiences have removed any fears which were originally felt about storage and dispensing operations during sub-zero weather, with the 65 per cent butane-35 per cent propane fuel now being used.

While it is a fact that Spokane winters can be classed as only moderately cold, butane operations in a section of the country that experiences really low temperatures and continued severe winter weather, should be equally successful by increasing the propane content above the 35 per cent figure. The maximum summer air temperature in 1936 was 104°F. resulting in a corresponding gauge vapor pressure of 107 lbs. per square inch. So far at least, there has been no operation of the safety valves on the tanks as the result of excessive temperatures during the summer months.

As regards safety measures for the storage and handling of this relatively large amount of fuel inside the city limits, it will be noted by reference to Fig. 2 that in addition to all the other valves, a quick closing Fisher valve is installed between the main shut-off valve on the tank and all the other piping. These valves are held in the open position by a fusible link which will fail at relatively low temperatures. In the event of escaping fuel during fueling operations or some other accident, the closing of this Fisher valve precludes the possibility of any further escape of liquid; and since the tanks are constructed according to the specifications referred to above, it would be impossible to have a major conflagration even though the storage tanks were full and completely surrounded by flames. The entire fenced area of the yard is clear of all obstructions and with the prevailing winds and the natural air currents across the yard, the small amounts of vapor or liquid which might escape during fueling operations or changes in valves and piping for maintenance, inspection, etc., will be quickly dissipated, and present no particular hazard. As a further precaution, two portable fire engines have been provided, both of which have 50 feet of hose and two cylinders containing 50 lbs. of carbon dioxide each. These are strategically located away from the immediate vicinity of the tanks so as to be instantly available when their need may be indicated.

With reference to the facilities for dispensing the fuel, it was decided to provide duplicate equipment at both the bus fueling spots. Experience to date has proved the soundness of that decision. Fig. 3 shows

FIG. 1. General view of fueling yard showing storage tanks and dispensing islands.



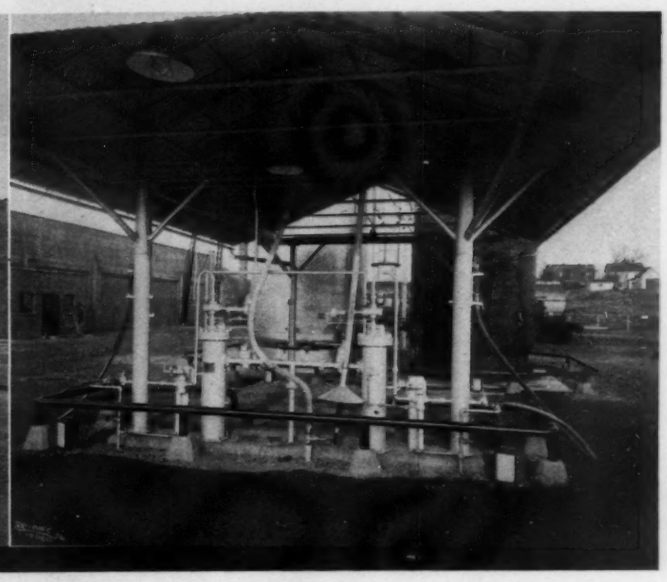


FIG. 2 (at left). Pumps, piping and valve arrangement, and small tank for emergency disposal of liquid fuel. FIG. 3 (at right). View showing duplicate metering and fueling facilities at dispensing island. The flexible canvas covered hose is used for emergency fuel disposal.

the general arrangement of the equipment at one of these two fueling islands. The 2-inch pipe shown in the center of the island foundation is the supply line and comes from the pumps which are located immediately in the rear of the large storage tanks. The large cylinders on either side of this supply line house the Smith meters. Between the meters and the fueling hoses are Fisher valves. It will be noted that either pump can pump fuel from either of the main storage tanks through either meter during fueling operations. Under normal operations, only one bus is fueled at a time although both hoses could be used simultaneously if it were so desired. The Fisher valve between the meter and the fueling hose is so connected that raising the handle starts the particular pump which it is desired to operate, and further raising of the handle opens the valve and admits liquid into the fueling hose and the bus fuel tank. Releasing the handle closes the valve and stops the pump. With this "deadman" control, the possibilities of discharging liquid fuel into the air as a result of failure of the hose, are reduced to a minimum. The fueling nozzle on the end of the duprene hose and the filling valve on the bus fuel tanks were designed by Parkhill-Wade and are described in some detail on page 195 of the Second Edition of "The Handbook of Butane-Propane Gases." Fire extinguishers of the usual wall type are provided at convenient locations under the sheds at each of the fueling islands. Each extinguisher holds 15 lbs. of carbon dioxide.

As previously stated, the second of the major problems involved in converting the fleet from gasoline to butane was the installation on the busses themselves of the necessary equipment. No particular difficulty was experienced in installing the carbureters, heat exchangers and the necessary copper tubing under the hood in the engine compartment. A typical installation is shown in Fig 4. Ensign carbureters and auxiliary equipment were used on the entire fleet. The real problem developed in connection with the design and installation of the fuel tanks. Here again the orders of the California Commission were rigidly followed. It was found extremely difficult to design and install fuel tanks of sufficient capacity with the basic restriction that the tanks must be cylindrical in shape and designed according to the A.P.I.-A.S.M.E. code. On some of the busses, a single tank was installed, although it was necessary to make certain changes in the structural framing of the bus in order to obtain the required road and differential housing clearances. On certain other types of busses, it was found impossible to install a single tank without prohibitive expense in the necessary changes to the frame of the bus itself. This particular problem was solved at the expense of much study and thought by designing an installation of two interconnected tanks, whose sizes and shapes were determined by the available space. All of the tanks were built with the 10 per cent outage tank as an integral part of the installation as designed by Parkhill-Wade and described on page 195 of the Second Edition of "The Handbook of Butane-Propane Gases." Every attempt was made, of course, to build a tank which would have sufficient capacity to enable the bus to make a full day's run without having to be refueled, and with very few exceptions this goal was achieved.

Normal Daily Routine

The normal daily routine of operation in the Spokane installation calls for fueling, inspecting and greasing the equipment during the hours of 1:30 a. m. to 5:00 a. m. so that all of the equipment is ready to start with the first scheduled run at approximately 5:30 a. m. As the various pieces of equipment come in from their runs for the day, either from tripper service at the end of the evening peak or at the completion of their runs at 1:30 a. m., they are fueled in the yard. The fueling procedure is to lock the nozzle shown in Fig. 3 into the fueling valve on the bus tank, and start the pump as described above. When the meter ceases to register, the tank is full and, of course, the meter readings determine the total number of liquid gallons put into the bus. It is impossible to fill the tank beyond its prescribed safe capacity due to the 10 per cent outage tank, and it is impossible not to fill the tank to its rated capacity as long as the hose connection is not broken and the pump kept running. For these reasons it was not considered necessary to provide liquid level gauges on any of the tanks, but each bus is equipped with a pressure gauge mounted on the instrument board and connected to the vapor space above the liquid in the tank. The fuel economy of the various types of equipment is a fairly known factor and those busses that have an insufficient fuel tank capacity to carry them through the entire day's operation, are returned to the yard and refueled during the valley of the load. Occasionally, a bus runs out of fuel while it is on the run, but these cases are exceptional and are the result of improper scheduling for that particular piece of equipment. As previously stated, this particular part of the whole problem caused more worry than any other phase of the conversion—the problems were difficult but not impossible of solution. With the present design of the modern gasoline driven bus, the conversion to butane includes an individual tank design for each make and type of bus, with the initial cost of the tank, and the changes necessary in the structure of the bus for the installation of the tank, as guiding and balancing features.

During the early part of the changeover operations, tests were made to determine the feasibility of fueling a bus which had run out of fuel while on its run. With no liquid level gauge on the tank and assuming that the pressure gauge referred to above would be of no value in giving any indication of reduced gallonage of fuel in the tank, it was assumed that the operator would have no information that he was beginning to run short on fuel. The first and only indication he would receive would

(Continued on Page 64)

European, Asiatic, and African Expansion of the Liquefied Petroleum Gas Industry

By EMERIC KROCH

EMERIC KROCH, D.Sc. M. Inst. Petr. Techn. (London), who contributes this article, is one of the pioneers of the bottled gas industry in Europe. Besides other activities, Mr. Kroch represents several American companies engaged in liquefied petroleum gas activities. He is the head of the engineering firm, "Etablissements Emeric Kroch" of Brussels, Belgium.

THE development of the liquefied petroleum gas industry outside of the United States, which still leads in quantities consumed but not in number of customers served, has been most satisfactory during the last two years.

EMERIC KROCH

In addition to the countries where the liquefied petroleum gas industry has been established for several years (France, Great Britain, Belgium, Germany, Poland, etc.), several countries both in and outside Europe now offer regular bottled gas service for domestic purposes and in some countries to industrial users as well.

Thus, butane is now being distributed in the Irish Free State, Spain, Switzerland and also in Northern Africa (Morocco, Algeria and Tunisia), French Equatorial Africa, the Belgian Congo, Palestine and the British Indies. In several other countries in Europe and outside of Europe, developments are afoot which may eventually mean the spreading of the industry throughout Europe and large areas in Asia and Africa.

The source of supply is of course the most important issue confronting every bottled gas distributing company. These sources can be grouped as follows:

1. Propane-butane: obtained from natural gas and natural gasoline.
2. Propane-butane (including unsaturated hydrocarbons): obtained from refinery gases.
3. Propane-butane from other sources: coke-oven gas, low temperature carbonization, etc.
4. Propane-butane: imported from other countries.

Classified by the source of supply, we find in Group 1 Poland and Roumania, which are the two European countries having an adequate supply of "wet" natural gas and also a number of natural gasoline plants and stabilizers. Italy, Germany and Hungary also have available not inconsiderable quantities of natural gas, but until now no appreciable amount of condensible hydrocarbons has been found in these gases.

Soviet Russia is a large producer of "wet" gas and natural gasoline and possibly also of propane and butane. A number of stabilizers are reported to have been built lately, partly by American engineering firms and partly by Russian engineers, but no reliable information has been made available at this writing as to the actual production and distribution of bottled gas.

In Group 2 we find France, which has 15 oil refineries, nearly all of them very up to date and equipped with cracking units, recovery plants and stabilizers. France's potential supply of liquefied petroleum gas from refinery sources exceeds her actual needs. It is possible that the application of the polymerization process will divert a considerable amount of sources now available for the manufacture of liquefied petroleum gases, but even in that case it may be safely stated that France's supply will remain more than sufficient for her bottled gas requirements.

Refineries in Great Britain are said to be also producing propane and butane but none of it appears to be marketed at this time.

In Holland a very large refinery belonging to the Royal Dutch Shell group will be shortly in a position to supply all the requirements of that country and also of substantial quantities for export. The refinery is scheduled to be put in operation in 1937.

FIG. 1. Acide Carbonique Pur, S. A., Belgium, serves bottled gas under the name, "Ultrabutane." The equipment is of American make.

Most prominent in Group 3 are Great Britain and Germany. Both countries produce propane and butane as by-products from the utilization of coal. The Imperial Chemicals, Ltd. and I. G. Farbenindustrie control the production of synthetic propane and butane in their respective countries.

Group 4 includes all other countries and also those which, like France, although being themselves producers of liquefied petroleum gases, are still importing considerable quantities of them, chiefly from the United States. The reason for this is rather obvious: the liquefied petroleum gases imported from the United States, being a natural gas product, are entirely free from unsaturated hydrocarbons and therefore the foul odor which accompanies cracked propane and butane is absent. American propane and butane are used to a large extent either pure or mixed with the cracked product as domestic bottled gas in France. Many other countries, such as Belgium, Spain, Switzerland, etc., rely entirely on imports for their bottled gas supply.

After these general remarks, a few lines will be devoted to the description of the industry in the various countries, listed in alphabetical order.

Austria: Polish propane and butane have been imported into Austria in odd lots during the last two years. The question of a distribution throughout the country is still at an experimental stage, but it is very likely that a limited service will be offered shortly.

Belgium: The distribution of liquefied petroleum gases in Belgium on a commercial scale began about three years ago; and although the results have not been what might have been anticipated, they are nevertheless, on the whole, satisfactory.

Belgium is a small but very densely populated country and the distribution of electricity and manufactured gas is extremely well disseminated. There are but a few of the smallest hamlets and communities in Belgium which do not have electric current and while numerically a great number of them do not have gas service, the vast majority of the population lives in towns and hamlets connected with a gas main.

The development of the Belgian coke oven industry made the majority of the municipally owned gas works disappear and replaced them by gas holders connected with the main leading from one of the large manufacturing

FIG. 2. An example of liquefied petroleum gas equipment used in Germany. The cylinders are placed outside the house, as only few inside installations are approved in Germany.

centers. Thus, Belgium is probably the best equipped country in Europe in regard to efficient and inexpensive manufactured gas service.

The four companies which are engaged in distributing liquefied petroleum gas in Belgium are as follows:

1. Acide Carbonique Pur, S. A.: The company's product sold under the trade name of Ultrabutane is a mixture of propane and butane/iso-butane and is supplied by a French refinery situated near the Belgian border.

The equipment used is of American make, the cylinders having an approximate capacity of 44 lbs. of gas. (See Fig. 1.)

This company, whose principal line of business is the manufacture and sale of carbonic gas, distributes Ultrabutane through subsidiaries and a few district distributors.

2. American Petroleum Co., S. A.: This company, which is owned by the Standard Oil Co. of New Jersey group, distributes a mixture of propane and butane under the trade-name of Primagaz.

Cylinders, cylinder valves and regulators are similar to those used by Liotard in France (see under "France") and are partially manufactured in that country.

The gas itself is produced near Rouen, France, in the refinery owned by the Standard Franco-Americaine De Raffinage.

3. Le Gazol, S. A. This company distributes, under the trade-mark, Gazol, a mixture of propane, butane and iso-butane imported from Poland.

The product is sold in the same cylinders in which it is shipped from the producing center via Gdynia to Antwerp. These cylinders measure approximately 9 x 49 inches and contain 55 lbs. of gas.

4. Butagaz, S. A.: A subsidiary of the French corporation of the same name, Butagaz distributes liquefied petroleum gases in Belgium, using cylinders of 29 lbs. capacity each. The equipment used is partly of French and partly of Belgian manufacture. The gas is supplied from a refinery controlled by the Royal Dutch Shell group near Rouen.

Statistics supplied by the Belgian Customs Administration show that approximately 450 metric tons of liquefied petroleum gas were imported during 1936. Since Belgium produces none itself, the above figure represents roughly the total consumption. France, Poland and the United States, in the order mentioned, supply the fuel to Belgium.

Baltic Countries: No information has been made available as to the distribution in the Baltic countries, viz.: Lithuania, Latvia, Esthonia and Finland. Poland would be the logical source of supply for these countries and although some isolated sales may have been made, no attempt has been recorded for organizing a permanent distributing company.

Czechoslovakia: No distribution at this time. A number of refineries are studying the possibilities of entering the field. Poland or Roumania would be the logical source of supply.

Denmark: Currency and import restrictions make it difficult for Danish importers to obtain the necessary authorization.

The Dansk Flaskegas Co. is at present the only distributing company in Denmark, their source of supply being Poland. The quantities marketed appear to be very small.

France: France is prominent in the bottled gas industry both in regard to the quantities consumed as well as to the number of customers served. No detailed statistics are available, but it is estimated that 400,000 customers use over eight million gallons of bottled gas a year. This is by far the largest figure for any country in the world, with the exception of the United States.

As indicated at the beginning of this article, French refineries produce very large quantities of propane and butane. Considerable quantities of "natural" liquefied petroleum gas are being imported from abroad, chiefly from the United States. Three companies are actively engaged in distributing bottled gas throughout the country, while a fourth company which put in an appearance about two years ago, is reported to be winding up its business.

These companies are the following:

1. Ancs. Ets. Liotard Freres, S. A.: This company, which is sponsored by the largest French refinery concern, markets a mixture of butane and iso-butane under the trade-name of Primagaz.

The cylinders used hold about 28 lbs. of gas. Very simple valves and regulators are used, the low cost of an installation being essential, due to the wide dissemination of the company's activities. Several thousand dealers in Primagaz assure an extensive service throughout the country. Subsidiaries are selling the gas under the trade-name of Primagaz in French Africa, Syria and Palestine. Agencies operate in Germany and Switzerland.

2. Modiano (Societe D'Exploitation Des Gaz Liquefies, S. A.): This company sells under the trade-name of Butasem a mixture of butane and iso-butane produced partially by a French refinery situated in the north of France and partially imported from the United States. The cylinders are much smaller than those commonly encountered in France, measuring 9 x 20 inches, weighing 23 lbs. and holding 20 lbs. of gas.

The cylinders have a built-in regulator

(Continued on Page 86)

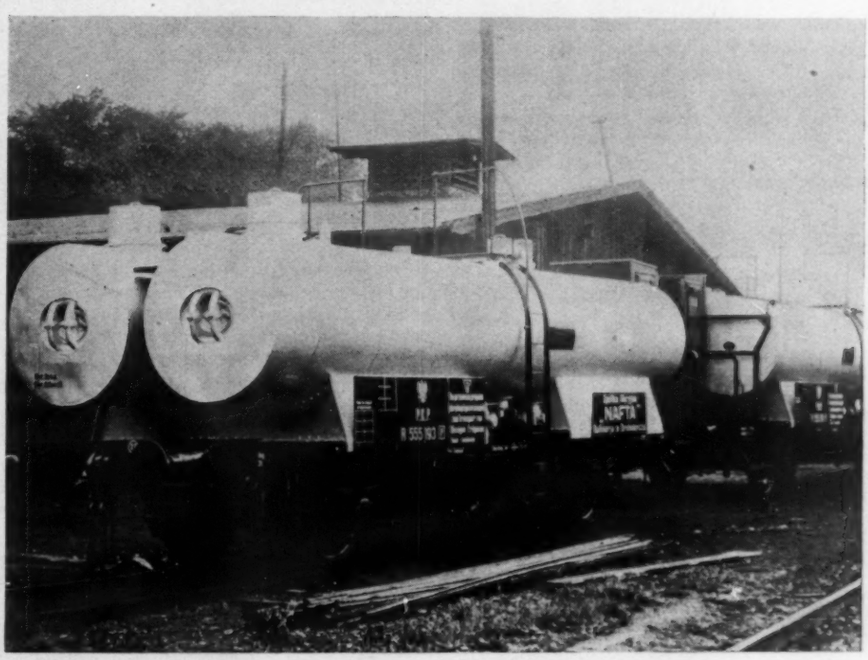
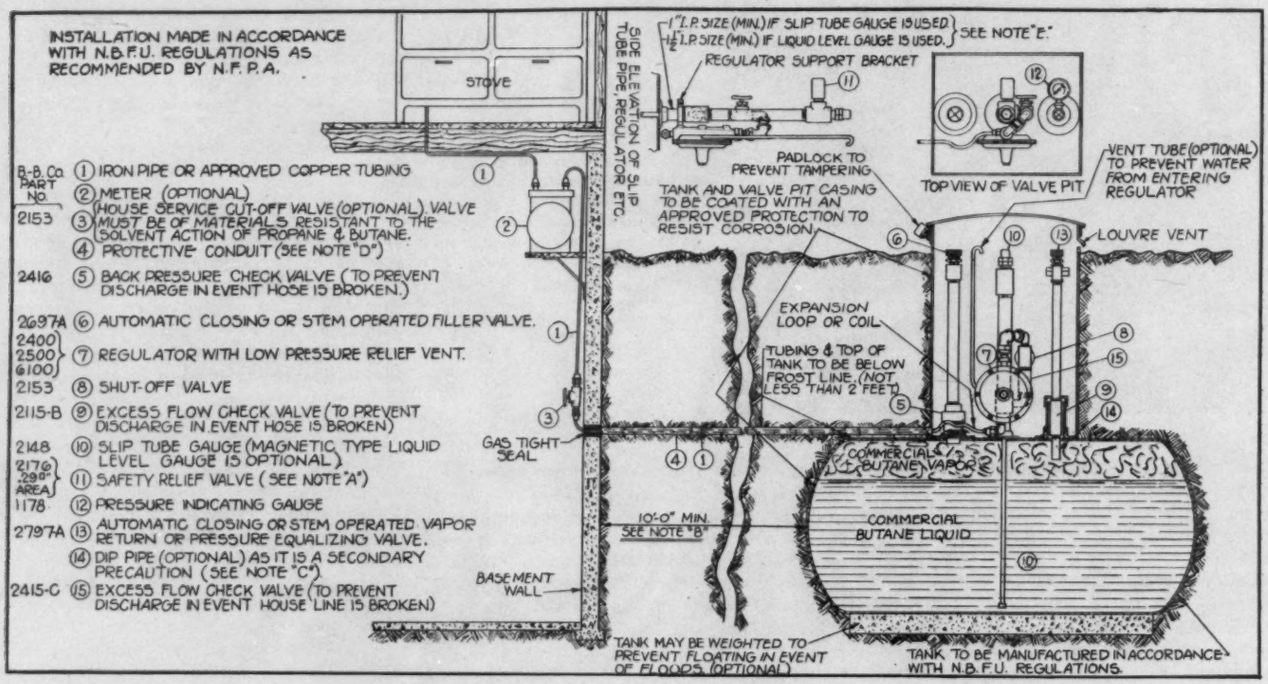


FIG. 3. Specially built tank cars of the Malopolska Co., Boryslaw, Poland, used in transporting liquefied petroleum gases.


INSTALLATION MADE IN ACCORDANCE WITH N.B.F.U. REGULATIONS AS RECOMMENDED BY N.F.P.A.
STOVE
SIDE ELEVATION OF SLIP TUBE PIPE, REGULATOR ETC.
1" I.P. SIZE (MIN.) IF SLIP TUBE GAUGE IS USED.
1½" I.P. SIZE (MIN.) IF LIQUID LEVEL GAUGE IS USED.
SEE NOTE "E."
REGULATOR SUPPORT BRACKET
PADLOCK TO PREVENT TAMPERING
TANK AND VALVE PIT CASING TO BE COATED WITH AN APPROVED PROTECTION TO RESIST CORROSION.
TOP VIEW OF VALVE PIT
VENT TUBE (OPTIONAL) TO PREVENT WATER FROM ENTERING REGULATOR
LOUVRE VENT
EXPANSION LOOP OR COIL
TUBING & TOP OF TANK TO BE BELOW FROST LINE. (NOT LESS THAN 2 FEET)
GAS TIGHT SEAL
COMMERCIAL BUTANE VAPOR
COMMERCIAL BUTANE LIQUID
10'-0" MIN. SEE NOTE "B"
BASEMENT WALL
TANK MAY BE WEIGHTED TO PREVENT FLOATING IN EVENT OF FLOODS (OPTIONAL)
TANK TO BE MANUFACTURED IN ACCORDANCE WITH N.B.F.U. REGULATIONS.
B-B Co PART NO.
2153 (1) IRON PIPE OR APPROVED COPPER TUBING
(2) METER (OPTIONAL)
(3) HOUSE SERVICE CUT-OFF VALVE (OPTIONAL) VALVE MUST BE OF MATERIALS RESISTANT TO THE SOLVENT ACTION OF PROPANE & BUTANE.
(4) PROTECTIVE CONDUIT (SEE NOTE "D")
2416 (5) BACK PRESSURE CHECK VALVE (TO PREVENT DISCHARGE IN EVENT HOSE IS BROKEN.)
2697A (6) AUTOMATIC CLOSING OR STEM OPERATED FILLER VALVE.
2400 2500 6100 (7) REGULATOR WITH LOW PRESSURE RELIEF VENT.
2153 (8) SHUT-OFF VALVE
2115-B (9) EXCESS FLOW CHECK VALVE (TO PREVENT DISCHARGE IN EVENT HOSE IS BROKEN)
2148 (10) SLIP TUBE GAUGE (MAGNETIC TYPE LIQUID LEVEL GAUGE IS OPTIONAL)
2176 .294" AREA (11) SAFETY RELIEF VALVE (SEE NOTE "A")
1178 (12) PRESSURE INDICATING GAUGE
2797A (13) AUTOMATIC CLOSING OR STEM OPERATED VAPOR RETURN OR PRESSURE EQUALIZING VALVE.
(14) DIP PIPE (OPTIONAL) AS IT IS A SECONDARY PRECAUTION (SEE NOTE "C").
2415-C (15) EXCESS FLOW CHECK VALVE (TO PREVENT DISCHARGE IN EVENT HOUSE LINE IS BROKEN)

NOTES

Note "A"—For required relief areas see N.B.F.U. regulations.

Note "B"—See N.B.F.U. regulations for complete requirements.

Note "C"—Dip Pipe to be of sufficient length to extend down to the permitted filling level.

Note "D"—Use protective conduit when copper tubing is used.

Note "E"—When gauging device is installed in same pipe to which relief is attached, net area of pipe must permit free flow equal to area of relief with any position of gauging device.

FIG. 1. UNDERGROUND A. S. M. E. TANK—COMMERCIAL BUTANE—BATCH VAPORIZATION, NO ARTIFICIAL HEAT.

Individual Consumer Bulk Systems

By ELLSWORTH L. MILLS

Vice-President, The Bastian-Blessing Company

THE term "bulk systems" applied to domestic and similar installations (as differentiated from industrial and manufacturing installations) refers to those types of liquefied petroleum gas systems in which fuel is delivered to the premises in large quantities by means of a truck tank. Methods and cost of distribution and safety requirements of these systems differ materially as compared with "bottled gas" (portable) systems.

E. L. MILLS

Both systems, whether "bulk" or "bottled," are actually miniature city gas plants located on the premises of the property owner. This fact must *never* be overlooked by the marketer in designing, installing, servicing and maintaining the systems, nor by the owner during the period of operation. When properly designed, installed, serviced, maintained and operated they meet a long felt want on the part of suburban and rural populations for a safe, economical and convenient metropolitan gas service.

In the second edition of the *Handbook of Butane-Propane Gases,* Chapter XV, pages 259 to 262, under the heading, "One-drum Distribution" and "Distribution on a Public Utility Basis," the authors briefly outline systems and methods of distribution that have proved increasingly popular and advantageous (particularly in certain sections of the country) since the publication of the last edition of the Handbook.

Because the development is comparatively new and little authoritative information is available as to the economics, life and safety of the various types of systems, there is considerable difference in design, in character of fuel used and in methods of marketing. Moreover, because of these many differences, national, state and local regulations are at the time of writing somewhat inadequate and to some extent ambiguous and inconsistent.

The major object of designers and marketers of bulk systems is to reduce the cost of distribution of the fuel, thus reducing its selling cost to the consumer to a point closely approximating or equivalent to public utility service. In proportion to the attainment of this objective the quantity of fuel sold increases not only to the individual customer but to increased number of customers. At the lower costs it has been found possible to use the gas not only for conventional cooking, hot water heating and refrigerating but for house heating. Incidental to this increased consumption of fuel is a material increase in appliance sales, which fact is attracting the interest of many appliance manufacturers, distributors and dealers. While this interest on the part of appliance marketers is helpful, it is also somewhat dangerous in that they are not always as familiar as they should be with the hazards involved in distributing and handling the gases. They are inclined to attempt the assembly and sale of what might be termed "homemade" systems.

The bulk systems now being installed are roughly grouped in Table No. 1.

A. Underground A.S.M.E. Tanks—Commercial Butane—Batch Vaporization, No Artificial Heat (See Fig. 1):

This type of system is marketed widely in those parts of the country in which the ground temperature is uniformly high (above 32° F.). The large surface area of the tank in contact with the warm earth and the large liquid capacity (125 to 1,100 gallons) is relied upon to provide sufficient heat to cause complete vaporization of commercial butane. During the winter months some companies use a "winter fuel" which is commercial butane containing a slightly greater proportion of propane.

The fuel is delivered to the premises in truck tanks operated from a central storage station or the refinery. The retail delivered price ranges from 8 cents to 25 cents per gallon, depending upon the size of the customer's storage tank, quantity used per month and the distance from the central storage to the premises of the customer.

The customer's storage tank is buried in the earth with the top at a minimum of 2 feet below the surface. All of the regulating, control and safety equipment is placed in a housing which rests on or is permanently attached to the top of the storage tank.

The vapor is drawn off the liquid, passed through a pressure regulator, at which point the pressure is reduced to approximately 11-inch water column (6 ounces per sq. in.); thence through an underground piping system into the house or building; thence to the appliances.

Some designers of this type of system install "re-gasifiers" or traps for heavy ends. These re-gasifiers take many forms but in general consist of a trap in the low pressure line, buried well below the frost line, in which condensates collect during cold snaps and re-vaporize when the system and the ground warm up.

An interesting method of vaporizing the liquid fuel is used in the cold climates of Michigan, Indiana and Ohio. A number of these plants have been in operation for several years and are reported to be giving satisfaction. The tank is buried in the ground so that the top is 3 feet below the surface. The control and regulating equipment is housed in a manhole which is insulated with rock wool, or some other similar insulating material.

The fuel is delivered into and drawn from the large compartment shown in Fig. 2. As the vapor is withdrawn the resulting differential in pressure between the large and small compartments causes the gas to bubble, through the connection dip pipe, from the smaller to the larger container. The gas is then passed through a high pressure reducing regulator at which it is reduced to approximately 5 pounds; thence through an underground pipe into the building. The gas is further reduced in pressure in the basement by means of a low pressure regulator to approximately 11-inch water column. It is then passed through a meter; thence to the appliances.

B. Underground A. S. M. E. Tanks—Commercial Butane—Batch Vaporization With Artificial Heat (See Fig. 3, Page 55):

Some marketers furnish a system similar in all respects to those described under "A," except that means for supplying artificial heat to the tank are provided, such as passing the house cold water supply line or the sewage line through or adjacent to the tank.

C. Underground A. S. M. E. Tanks—Mixtures of Propane and Butane—Liquid Withdrawal, Flash Vaporization (Fig. 4):

To date these systems have been distributed in the colder, northern areas of the country. The fuel is delivered periodically by truck tank. Mixtures predominately propane (as high as 60 per cent propane) are used. The gas is usually metered and sold on a corrected B.t.u. basis at gas rates per thousand, corresponding to similar city gas.

The liquid fuel is drawn from the tank into a high pressure reducing regulator at which point it is expanded to about 5 to 10 lbs. pressure. The expansion from an average inlet or tank pressure of 35 lbs. to 5 lbs. vaporizes a large part of the fuel. It is then passed underground to the basement of the building. Installed near the ceiling of the basement is a heat exchanger consisting of copper tubing or fins in which the last of the liquid is vaporized. The pressure is finally reduced through a low pressure regulator to approximately 11 inches water column; thence through a meter to the appliance.

D. Underground I. C. C. Tanks—Commercial Propane—Batch Vaporization, No Artificial Heat (Fig. 5, Page 55):

This system has been in use for a number of years in the northern part of the country. Fuel is delivered periodically by truck tanks. A gas and water-tight manhole is attached to the top of the I. C. C. container. It has been found necessary in the severe climates in which these systems are used to provide water-tight manholes to prevent ice damage to the equipment. The

TABLE NO. 1. TYPES OF BUTANE AND PROPANE BULK SYSTEMS

CONTAINER		Code	Working Pressure	FUEL USED	APPROXIMATE VAPOR PRESSURE (GAUGE) at 70°F	at 100°F	METHOD OF VAPORIZATION	RANGE OF TANK SIZES IN GALS. OF FUEL	DIAGRAM
Underground	Buried in the Earth		100	Commercial Butane	35	60	Batch Vaporization	100 to 1100	No. A
			100		23	46	No artificial heat	120 to 2500	No. A[2]
		A.S.M.E.*	100	Commercial Butane	35	60	Batch Vaporization With artificial heat	116 to 1109	No. B
			125	Mixtures of Propane and Butane	75	124	Liquid Withdrawl Flash Vaporization	125 to 600	No. C
		I.C.C.	240	Commercial Propane	120	190	Batch Vaporization No Artificial heat	35 to 120	No. D
Above Ground	Installed on Foundation & Insulated	A.S.M.E.*	80	Commercial Butane	35	60	Batch Vaporization Artificial heat	250	No. E
	Installed on Foundation No Insulation	I.C.C.	240	Commercial Propane	120	190	Batch Vaporization No artificial heat	27.5 to 120	No. F

*The present tentative rules of the National Fire Protection Association require A.S.M.E. tanks. Previously the A.S.M.E. or A S.M.E.—A.P.I. tanks were permitted. A number of marketers have used the A.S.M.E.—A.P.I. specification.

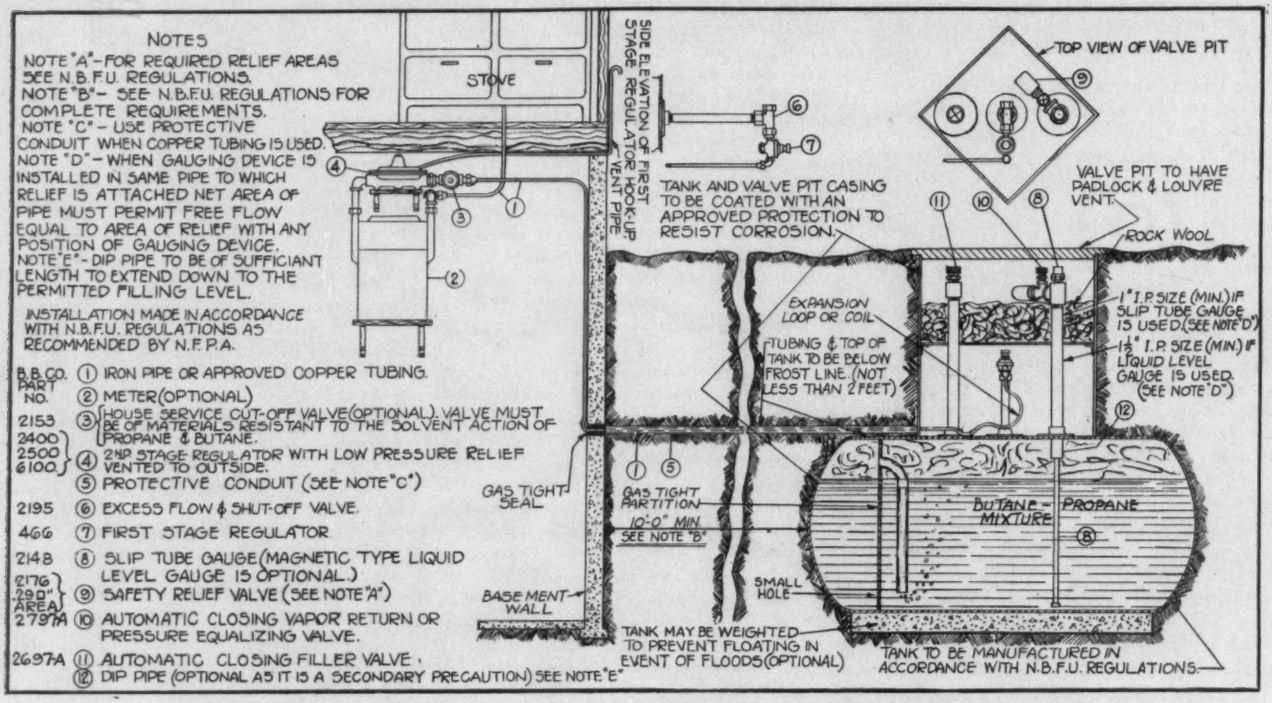

NOTES
NOTE "A"- FOR REQUIRED RELIEF AREAS SEE N.B.F.U. REGULATIONS.
NOTE "B"- SEE N.B.F.U. REGULATIONS FOR COMPLETE REQUIREMENTS.
NOTE "C" - USE PROTECTIVE CONDUIT WHEN COPPER TUBING IS USED.
NOTE "D" - WHEN GAUGING DEVICE IS INSTALLED IN SAME PIPE TO WHICH RELIEF IS ATTACHED NET AREA OF PIPE MUST PERMIT FREE FLOW EQUAL TO AREA OF RELIEF WITH ANY POSITION OF GAUGING DEVICE.
NOTE "E" - DIP PIPE TO BE OF SUFFICIANT LENGTH TO EXTEND DOWN TO THE PERMITTED FILLING LEVEL.
INSTALLATION MADE IN ACCORDANCE WITH N.B.F.U. REGULATIONS AS RECOMMENDED BY N.F.P.A.
B.B.CO. PART NO.
① IRON PIPE OR APPROVED COPPER TUBING.
② METER (OPTIONAL)
2153 ③ HOUSE SERVICE CUT-OFF VALVE (OPTIONAL). VALVE MUST BE OF MATERIALS RESISTANT TO THE SOLVENT ACTION OF PROPANE & BUTANE.
2400 2500 6100 ④ 2ND STAGE REGULATOR WITH LOW PRESSURE RELIEF VENTED TO OUTSIDE.
⑤ PROTECTIVE CONDUIT (SEE NOTE "C")
2195 ⑥ EXCESS FLOW & SHUT-OFF VALVE.
466 ⑦ FIRST STAGE REGULATOR
2148 ⑧ SLIP TUBE GAUGE (MAGNETIC TYPE LIQUID LEVEL GAUGE IS OPTIONAL.)
2176 290" AREA ⑨ SAFETY RELIEF VALVE (SEE NOTE "A")
2797A ⑩ AUTOMATIC CLOSING VAPOR RETURN OR PRESSURE EQUALIZING VALVE.
2697-A ⑪ AUTOMATIC CLOSING FILLER VALVE.
⑫ DIP PIPE (OPTIONAL AS IT IS A SECONDARY PRECAUTION) SEE NOTE "E"
STOVE
SIDE ELEVATION OF FIRST STAGE REGULATOR HOOK-UP
VENT PIPE
TOP VIEW OF VALVE PIT
VALVE PIT TO HAVE PADLOCK & LOUVRE VENT.
TANK AND VALVE PIT CASING TO BE COATED WITH AN APPROVED PROTECTION TO RESIST CORROSION.
ROCK WOOL
EXPANSION LOOP OR COIL
TUBING & TOP OF TANK TO BE BELOW FROST LINE. (NOT LESS THAN 2 FEET)
1" I.P. SIZE (MIN.) IF SLIP TUBE GAUGE IS USED (SEE NOTE "D")
1½" I.P. SIZE (MIN.) IF LIQUID LEVEL GAUGE IS USED (SEE NOTE "D")
GAS TIGHT SEAL
GAS TIGHT PARTITION
10'-0" MIN. SEE NOTE "B"
BUTANE - PROPANE MIXTURE
BASEMENT WALL
SMALL HOLE
TANK MAY BE WEIGHTED TO PREVENT FLOATING IN EVENT OF FLOODS (OPTIONAL)
TANK TO BE MANUFACTURED IN ACCORDANCE WITH N.B.F.U. REGULATIONS.

FIG. 2. UNDERGROUND A. S. M. E. TANK—COMMERCIAL BUTANE—SPECIAL VAPORIZATION.

first-stage high pressure regulator, filler and shut-off valve are housed in this manhole.

The gas pressure is reduced to about 2 to 5 lbs. in the first-stage regulator, passed underground into the house and then reduced again in a second-stage low pressure regulator to 11 inches water column; thence through a meter to the appliances. The gas consumed is billed monthly on a utility basis.

E. Above-Ground A. S. M. E. Tanks—Commercial Butane — Batch Vaporization, Artificial Heat (See Fig. 6):

This system consists of a tank with three legs so attached that it will be upright or vertical while in service. A blanket of Rockwool 2 inches thick applied to the inside of a metal jacket completely insulates the tank with its control equipment and serves to make the unit thermally efficient. This jacket consists of three sections held together by locking strips and a removable, slightly conical, cover. By removing this cover and sliding the locking strips upward, the jacket may be removed to permit inspection of entire surface of tank without interrupting service. Lifting of the cover provides access to the control equipment consisting of regulator, high and low pressure relief valves, and the pressurestat.

Through the bottom head and the shell of the tank is welded a bent, extra-heavy, seamless steel flue (see Fig. 6). The lower protruding end of this flue is welded to the burner box. One end of the air intake line, which supplies air to the burner, is welded to the back of the burner box. The other open ends of both the flue and air intake protrude beyond the insulating jacket to receive the draft equalizer. In the burner box, a Klixon burner, very similar to the type used in an Electrolux gas refrigerator, is installed so that the products of combustion rise in the flue and out through the draft equalizer after giving up its heat to the liquid butane through the wall of the flue. A pilot is used in the burner box to keep the Klixon burner valve open and to effect ignition of the gas when the pressurestat opens allowing gas to flow to the burner. This pressurestat is an automatic valve serving the same purpose as a thermostat might except the pressurestat is actuated by the pressure in the tank instead of temperature. It is usually adjusted to hold 10 lbs. gauge pressure in the tank; that is, when the pressure in the tank during cold weather is reduced to 10 lbs., the pressurestat valve opens allowing gas to flow to the burner. The pilot ignites the gas and the resultant heat, applied through the walls of the flue submerged in the butane, raises the pressure in the tank. When the pressure reaches approximately 10½ lbs. the pressurestat cuts the gas off. The pilot is lighted when gauges are read in December and is extinguished by the gauge reader in March of each year. The burner actually burns a total of about 50 hours during an average heating season around Dallas on an average domestic load. The burner consumes about 1.5 cu. ft. of vapor (at 11-inch water pressure) per hour, and the pilot about 0.05 cu. ft. per hour. The total butane required for burner and pilot is only about 7 gallons per year, amounting to 77 cents per season or $.25 per month for the three winter months.

A regulator reduces the tank pressure to 11 inches of water at which pressure it leaves the tank and is delivered through the yard line and house piping to appliances. All piping, including the yard line, is laid to grade and slopes downward to one low point in the yard line. The yard line is laid below the frost line. At the low point, a "trap" is laid consisting of about 20 feet of one-inch pipe also laid to grade below the frost line. With this piping system, any condensation that might take place in the exposed part will drain into the "trap" and the heat of the ground revaporize it.

A high pressure relief valve set to relieve at 80 pounds pressure (the working pressure of the tank) is attached to the tank to prevent excess pressures from building up in the tank in case of grass or weed fires, or any other unusual condition that might cause high pressures.

A low pressure relief valve set to relieve at one pound pressure is used on the service line that connects to the yard line and house piping.

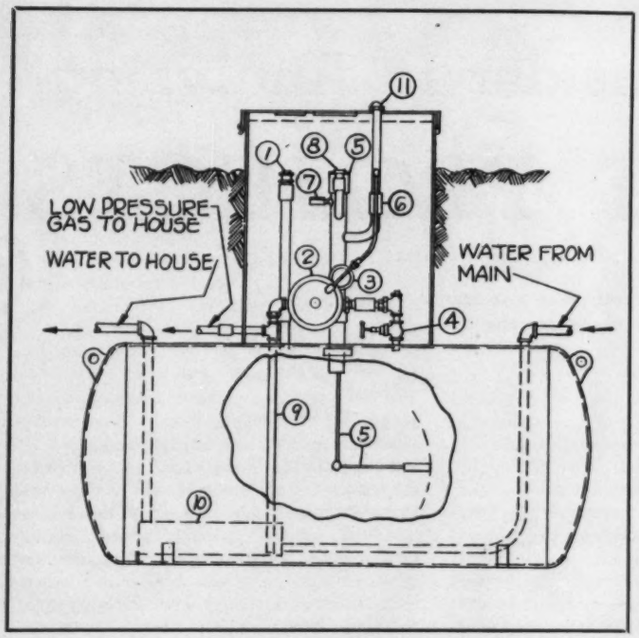
The vents from both relief valves are connected to a common vent line, one inch in size, which extends about 10 feet above the unit to carry off any vapor should either relief valve open. A loosely fitting cap is used on the open end of the vent to prevent rain from getting into it.

A very sensitive magnetic type gauge graduated in gallons is used to indicate the contents of the tank.

The tanks, insulating jackets, controls, fittings, gauges and the various other parts of the units are assembled into complete units and thoroughly tested at division shops from which points surrounding districts are supplied.

Reinforced concrete ring foundations of rich mixture are precast and weathered in wet sand and stored at the district warehouses. One is carried out to the job along with the assembled units, appliances and pipe and fittings, all on the installation truck. This ring foundation is laid in solid soil and leveled and the unit set on it. A suit-

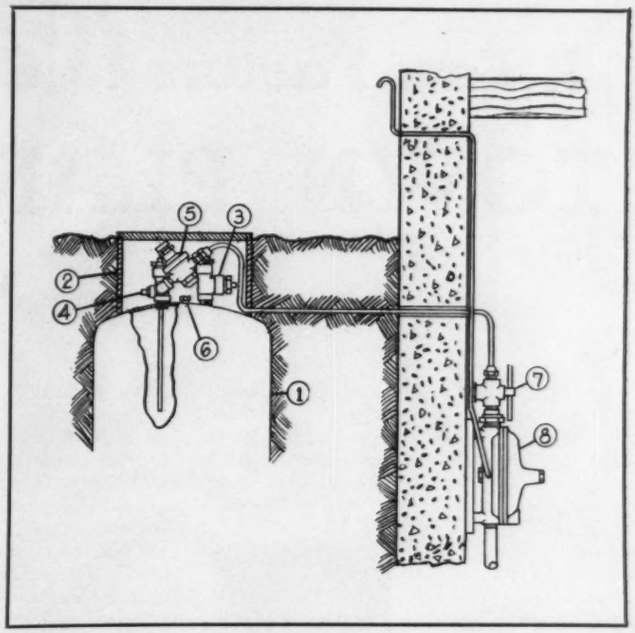
(Continued on Page 70)



LEGEND

1. Automatic closing filler valve
2. Pressure regulator
3. House line relief valve
4. House line shut-off valve
5. Liquid level gauge—magnetic type
6. High pressure safety relief valve
7. Pressure indicating gauge
8. Pressure equalizing automatic closing valve
9. Condensation re-vaporizer
10. Water coil
11. Relief vent

FIG. 3. UNDERGROUND A. S. M. E. TANK—COMMERCIAL BUTANE—BATCH VAPORIZATION, WITH ARTIFICIAL HEAT.



LEGEND

1. ICC Cylinder
2. Gas tight housing
3. Filler valve
4. House line valve with liquid level dip pipe and vent
5. First stage regulator
6. Fuse plug
7. House service cut-off valve
8. Second stage regulator with relief valve vented to the outside

FIG. 5. UNDERGROUND I. C. C. TANKS—COMMERCIAL PROPANE—BATCH VAPORIZATION, NO ARTIFICIAL HEAT.

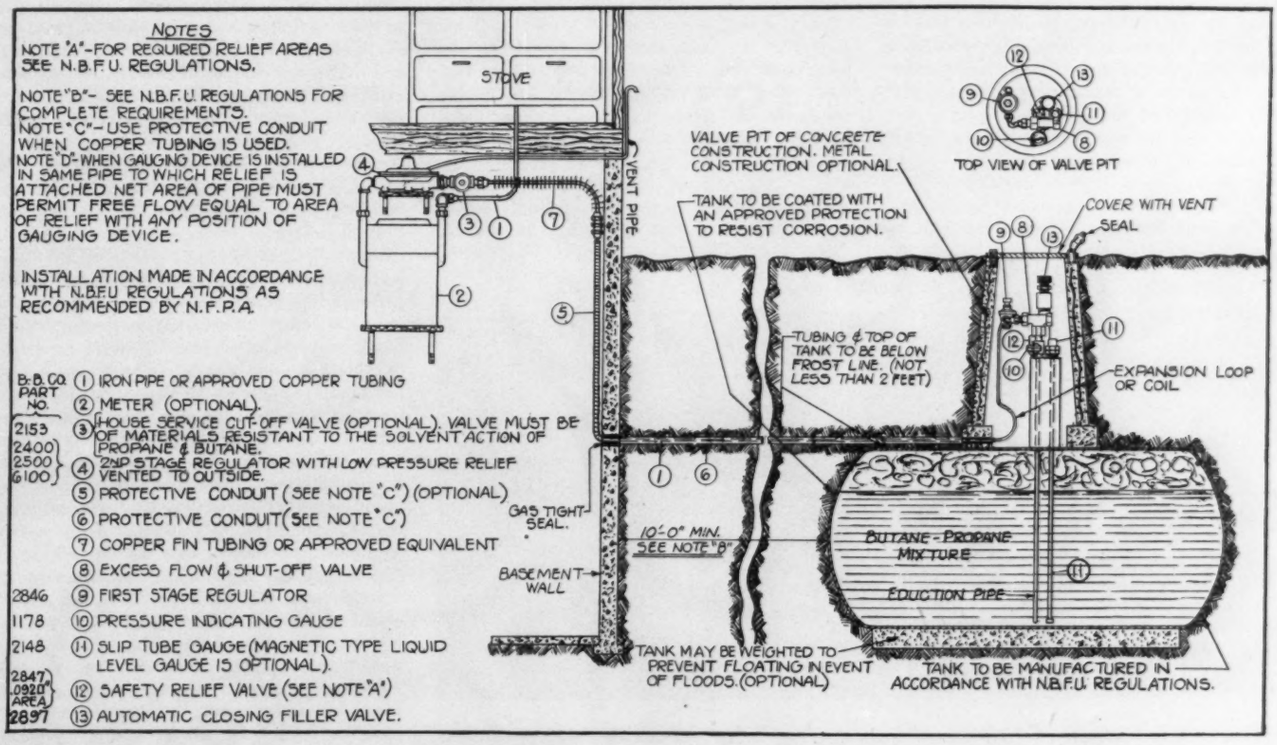

NOTES
NOTE "A"-FOR REQUIRED RELIEF AREAS SEE N.B.F.U. REGULATIONS.
NOTE "B"- SEE N.B.F.U. REGULATIONS FOR COMPLETE REQUIREMENTS.
NOTE "C"- USE PROTECTIVE CONDUIT WHEN COPPER TUBING IS USED.
NOTE "D"-WHEN GAUGING DEVICE IS INSTALLED IN SAME PIPE TO WHICH RELIEF IS ATTACHED NET AREA OF PIPE MUST PERMIT FREE FLOW EQUAL TO AREA OF RELIEF WITH ANY POSITION OF GAUGING DEVICE.
INSTALLATION MADE IN ACCORDANCE WITH N.B.F.U. REGULATIONS AS RECOMMENDED BY N.F.P.A.
STOVE
VENT PIPE
VALVE PIT OF CONCRETE CONSTRUCTION. METAL CONSTRUCTION OPTIONAL.
TOP VIEW OF VALVE PIT
TANK TO BE COATED WITH AN APPROVED PROTECTION TO RESIST CORROSION.
COVER WITH VENT SEAL
TUBING & TOP OF TANK TO BE BELOW FROST LINE. (NOT LESS THAN 2 FEET)
EXPANSION LOOP OR COIL
B-B CO. PART NO.
(1) IRON PIPE OR APPROVED COPPER TUBING
(2) METER (OPTIONAL).
2153 (3) HOUSE SERVICE CUT-OFF VALVE (OPTIONAL). VALVE MUST BE OF MATERIALS RESISTANT TO THE SOLVENT ACTION OF PROPANE & BUTANE.
2400 2500 6100 (4) 2ND STAGE REGULATOR WITH LOW PRESSURE RELIEF VENTED TO OUTSIDE.
(5) PROTECTIVE CONDUIT (SEE NOTE "C") (OPTIONAL)
(6) PROTECTIVE CONDUIT (SEE NOTE "C")
(7) COPPER FIN TUBING OR APPROVED EQUIVALENT
(8) EXCESS FLOW & SHUT-OFF VALVE
2846 (9) FIRST STAGE REGULATOR
1178 (10) PRESSURE INDICATING GAUGE
2148 (11) SLIP TUBE GAUGE (MAGNETIC TYPE LIQUID LEVEL GAUGE IS OPTIONAL).
2847 .0920" AREA (12) SAFETY RELIEF VALVE (SEE NOTE "A")
2897 (13) AUTOMATIC CLOSING FILLER VALVE.
GAS TIGHT SEAL.
10'-0" MIN. SEE NOTE "B"
BASEMENT WALL
BUTANE-PROPANE MIXTURE
EDUCTION PIPE
TANK MAY BE WEIGHTED TO PREVENT FLOATING IN EVENT OF FLOODS. (OPTIONAL)
TANK TO BE MANUFACTURED IN ACCORDANCE WITH N.B.F.U. REGULATIONS.

FIG. 4. UNDERGROUND A. S. M. E. TANKS—MIXTURES OF PROPANE AND BUTANE—LIQUID WITHDRAWAL, FLASH VAPORIZATION.

A Few Factors to Consider In Analyzing TOWN PLANT PROJECTS

By W. G. WATKINS Manager Skelgas Service, Skelgas Company

THERE are available at present enormous quantities of liquefied petroleum gas fuels and solvents from the natural gasoline industry which are augmented by additional sources of supply from the oil refining industry. This unlimited supply as permanent as the oil industry, affords the utility operator or industrial user a satisfactory fuel supply. It is anticipated that this type of fuel will make gas service available to practically the entire United States from the isolated dwelling to the small sized towns and industrial consumers; particularly the small town which heretofore could not justify the investment required for a natural or manufactured gas supply.

W. G. WATKINS

Methods of distribution and utilization of fuel in cylinders for domestic uses and light industrial uses such as torches, steel cutting, small furnaces, etc., have been perfected and proven by use to the extent that this class of gas service has become definitely established. Municipal and industrial plants using either a pure fuel or a diluted gas are also definitely established in the gas industry.

Butane air plants and propane gas plants in municipal installations have made rapid progress and from present indications there may be an unfavorable reaction due to earnings in some instances not reaching expectations. This condition is perhaps largely due to two factors: (1) the temporary general tendency on the part of the consumers to restrict expenditures and economize; and (2) to the plant operators not thoroughly analyzing their prospective properties. Efforts have been made to counteract the latter condition by a classification of the projects and their basis of operation, the design of plants and distribution systems; first to meet the individual requirements and, in the case of group operations, to fit the individual projects into a well balanced method of group operation.

The investment required for an individual installation of this type is so small that operations of this type generally involve several towns. Such operations afford operating economies, savings in purchases, etc., not available in the case of an individual operation. On this type of operation it is apparent that standardized construction and a proper method of operation are essential for economical operation.

After the selection of a prospective town or group of towns, an accurate survey of their present conditions from the statistics available and of the investment required should be made and anticipated earnings calculated as accurately as possible. Considerable attention should be given to the progressiveness of the town and similar factors rather than relying on its size as the fundamental factor in gas sales. The distribution system should be worked out to almost final accuracy as this feature represents the bulk of the original investment and has important bearings on future operating costs.

Generally one is too optimistic in the gas sales anticipated from a new installation. The class of consumers available for this type of gas service is not directly comparable to any past experience of the gas industry. The risk factors are higher and the majority of the consumers are generally not as prosperous as in the larger small towns where manufactured or natural gas service is available. Under such conditions they are naturally slower to take up a new commodity and are more economical in its use. It is apparent, therefore, that to handle such projects on a conservative basis one should carefully analyze each prospective situation when considering the method of operating it.

In order to establish a satisfactory starting load and reduce the high initial operating costs inherent with new installations, plans should be made to carry on an intensive sales effort during the last few weeks of construction and the first few months of operation. This operation is generally self-supporting from appliance profits, and a good start in these small operations means much towards the success of the project and a quick saturation. Satisfactory public relations, particularly in obtaining the franchise and during the period of construction, are also important from a load building angle. Assistance in appliance merchandising is generally available from the appliance manufacturers and local merchants, which is of material assistance. However, in this class of service, sales efforts may be readily overdone, as this class of people is generally slow in acceptance of a new service and any high pressure sales do not advance but rather retard load building.

With reference to the class of service contemplated, there has been much discussion of low rates for house heating loads. There perhaps is a general tendency on the part of some operators to over-estimate the income from this class of service. Certainly one cannot hope to sell a relatively expensive gas for heating purposes to the general class of consumers served by these installations the same as to city people who are accustomed to spending money for convenience. In communities where people are used to relatively cheap wood or coal fuels they generally are not the type to quickly appreciate the saving in time, convenience, etc., available through the use of gas even if at the same rate as their present fuel. Also, it has been experienced that after this class of consumer has purchased a new range, perhaps a water heater, and piped his house, he is rather reluctant to consider any near future expenditure such as required for heating. While the intent of the foregoing is not to underestimate or overlook house heating loads, it is

FIG. 1. Fully automatic butane air plant showing two liquid fuel and two high pressure gas holders.

endeavored to point out a few of the peculiarities encountered in the average small town operation. With the proper set-up, profitable house heating loads, particularly of the small space heater type, can be acquired.

If house heating is not considered, there remains only the domestic cooking and water heating loads, and the usual special loads such as car washing machines, vulcanizing outfits, cleaner's establishments, restaurants and similar businesses, all of which usually take a commercial rate.

While there are many methods for calculating anticipated earnings from this type of project, the following basis has been found most nearly correct in so far as data are available for substantiation. The ultimate average saturation is taken at 70 per cent of the number of dwellings, shacks and temporary loads not included. This 70 per cent factor is also about 70 per cent of the number of service taps provided in the mains at time of installation. That is, as it is cheaper to install these connections at the time of construction, a service connection is generally provided for each building lot in the sections which are anticipated to develop, etc.

In normal times, with an active selling campaign, three to four years may be considered a reasonable period in which to acquire the bulk of the load; for example, 80 per cent of the ultimate saturation. Chart No. 1 shows the rate at which the load was acquired in that instance, and the effect of the recent depression is clearly reflected. The remaining 20 per cent is equally distributed over the remaining life of the project which is considered as being the life of the franchise. The foregoing data were developed for the average town of the class applicable to butane air gas service ranging from 2500 to 7000 in population.

Gas consumption varies considerably and during the early life of the project is rather low. Average consumption during the first year is approximately 1200 cu. ft. per month, including the special loads mentioned above but exclusive of space heating. However, as water heating loads increase and the consumers and inhabitants become more gas minded, this is expected to approximate 2000 cu. ft. per consumer. The rate of growth of the load and the rates of consumption are perhaps conservative but are based on experience.

The type of plant depends on the gas load and on the basis of operation. The types of plants used in such installations fall into four classifications.

Propane Plants: This type of plant which provides for the furnishing of an undiluted gas product, usually propane, or propane-butane mixtures, is suitable for towns of less than 2500 population and at present fuel costs its services are confined practically entirely to cooking and water heating loads. Such plants require no attention other than refilling of the fuel storage tanks and do not necessarily require gas vapor storage facilities. Installation costs average about $50 per consumer. Such operations when group operated afford appreciable savings and require very little operating overhead.

In this type of project the cost per consumer is high due to using an ultimate saturation of only 60 per cent. Distribution systems are generally of the high pressure type operating on medium pressures.

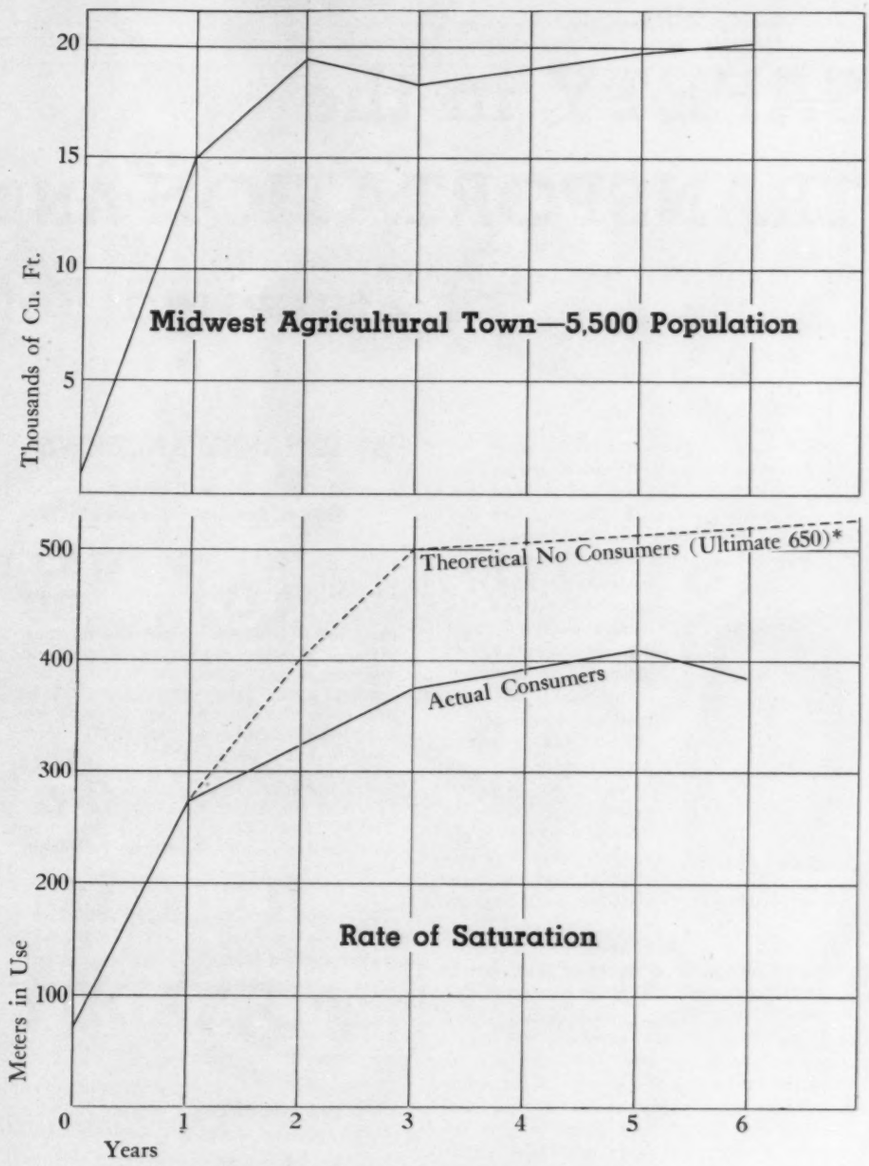


FIG.2. Average annual consumption per consumer.

Meteorological data indicate that even in severe climates subsoil temperatures are not deterring factors in so far as condensation of a propane fuel in the distribution system is concerned. While the average system would perhaps grade from 1½ down to 1-inch line, depending on conditions, the length of main per consumer on the basis of 60 per cent ultimate saturation is greater than in butane air projects, resulting in a higher investment than might be first expected. Also, the cost of the plant is perhaps higher than expected due to the added cost of constructing the liquid storage, etc., for higher working pressures than are required for butane air processes.

With a high pressure type (10 lb.) distribution system, service connections complete cost approximately $16.50 to $20.00 per consumer, making a total final cost per consumer of about $65.00 to $70.00.

Another feature to consider is the probability of having a lower B.t.u. value and cheaper gas available at a later date. In this case it is generally more advisable to install a distribution system designed for natural gas service, or whatever the ultimate gas service may be. Such a distribution system whether high pressure or low pressure will be adequate as a low pressure distribution system for the propane gas service. Costs of this system (low pressure propane service) as compared to an original (high pressure) propane distribution system will be a little more expensive due to the larger sized mains, and service lines, which will be somewhat offset by the saving in the individual regulators and relief valves for the high pressure propane system. Also, line losses and fluctuations in metering pressure on the high pressure systems are felt by some to increase the operating cost of this type of distribution as compared to low pressure distribution which should also be considered.

Batch Operated Butane Air Plants: This

(Continued on Page 98)

SAFETY in the TRANSPORTATION AND TRANSFER of Liquefied Petroleum Gases

By F. HARRY ANDREWS

Philgas Department
Phillips Petroleum Company*

THE use of liquefied petroleum gases for domestic, commercial and industrial applications has shown a marked increase for the past several years. In the liquefied gas industry, as in every growing industry, evils of improper handling are bound to creep in, unless proper precautions are taken and certain accepted rules for safe handling of products are practiced by operators. The purpose of this paper is to outline certain methods of proper handling of liquefied petroleum gases and to discuss the hazards attendant upon their use, with suggestions as to reducing such hazards to a minimum.

F. H. ANDREWS

Liquefied petroleum gases consisting of propane and butane, or mixtures of both, are, in a normal state, gases heavier than air. For economical transportation and storage, these gases are liquefied under pressure, and maintained in the liquid state until released or converted into a gas at the point of consumption. Liquefied petroleum gases obey the general laws of liquids and gases in that increased temperatures give increased vapor pressures. At temperature ranges from a —50° F. to 105° F., corresponding vapor pressures of commercial propane are from 0 to 212 lbs. per square inch gauge. The actual pressure at any given temperature would vary, dependent on the exact composition. In general, we may keep in mind the above temperature and pressure ranges.

The rapid development of the liquefied petroleum gas industry has been aided, to a great extent, by the close co-operation of major producers and marketers, with the safety and regulatory bodies in the promulgation of proper regulations for the storage, handling and utilization of these products. At present, by recommendation of the Committee on Gases of the National Fire Protection Association, the National Board of Fire Underwriters has adopted the following regulations:

N.F.B.U. Pamphlet No. 52—"Regulations for the Installation and Operation of Compressed Gas Systems other than Acetylene for Lighting and Heating."

N.F.B.U. Pamphlet No. 58—"Regulations for the Design, Installation and Construction of Containers and Pertinent Equipment for the Storage and Handling of Liquefied Petroleum Gases." (Although these regulations do not provide for bulk storage of other than general domestic and commercial types, the N.F.P.A. are reported to be amplifying these rules to also cover the domestic type of bulk installations where other than I.C.C. bulk containers are used.)

Regulations for the Design, Construction and Operation of Automobile Tank Trucks and Tank Trailers for the Transportation of Liquefied Petroleum Gases.

To reduce hazards to a minimum, it is essential on the part of every marketer to see that certain general rules are followed for the handling of liquefied petroleum gases. These are:

1. Proper selection of materials for the work involved.

2. Adoption and strict adherence to approved and safe rules for storing, handling, and transporting liquefied petroleum gas.

3. Careful selection of intelligent personnel, who have been thoroughly instructed in their work and who will adhere to the approved trade practices.

Too much cannot be said for the proper selection of materials. Care should be taken to see that valves, tubing, piping, cylinders, tanks, relief valves, etc., are properly designed for the work involved. Sometimes economic pressure or urgent customer demand makes for the paring of materials and workmanship to a minimum, both as to price and quality. This practice should not be tolerated, and it would be far better to lose a prospective customer of this nature than to make a borderline installation which is not up to accepted safety standards. Customer goodwill, obtained through use of best materials, correct application and maximum safety, are far more important than what is likely to be false profit on any individual installation.

Standard safe practices should be the credo of every marketer. A thorough study of best handling methods should be made for the type of installation involved, and a set of rules formulated. Strict adherence to these rules should be demanded from every employee.

The use of intelligent men for key jobs is of most importance. There is little use of purchasing the best equipment available, and then placing the responsibility for handling of material and fuel in the hands of unskilled workmen. Only those men whose uppermost thought is safety in handling liquefied petroleum gas should be employed. It is far better to show a slightly higher operating cost due to necessary wage standards than to run the risk of heavy losses resulting from careless or unintelligent handling by incompetent workmen.

For domestic and commercial purposes, liquefied petroleum gases are usually furnished in cylinders of from 20 to 300 lbs. fuel capacity. Such cylinders should be built in accordance with Interstate Commerce Commission Specifications. All such cylinders should be equipped with one or more safety devices. Formerly, these safety devices were either frangible discs or fusible plugs, or both. Frangible discs are thin metal discs of definite thickness calculated to burst at a predetermined pressure. Fusible plugs are plugs threaded into the cylinder and with a center core of fusible metal with a melting point of approximately 165° F. and of sufficient size to prevent excessive pressure build-up in case of fire surrounding the cylinder. Both devices exhaust the entire contents of the cylinder in case they operate. More recently, small spring-loaded relief valves either built into the cylinder valve or threaded into the cylinder have been used. Such devices have the advantage that they reseat upon alleviation of excessive pressure, due to any cause which does not destroy the relief valve itself. Frangible disc type of safety devices have given trouble because of premature bursting due to incorrect thickness or corrosion of the disc. For this reason, the Compressed Gas Manufacturing Association has recommended that only spring-loaded relief valves or fusible plugs be used as cylinder safety devices on any except cylinders for very high pressures.

Another recent development is the incorporation of a small excess flow valve in the cylinder valve, which prevents above normal flow of gas from the cylinder in case the high pressure gas line is broken during use.

Certain general rules should be followed in regard to the installation of aboveground

(Continued on Page 92)

*Presented before the Compressed Gas Manufacturers' Association, New York City, January 15, 1937.

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Cajalco Dyke and basin. In the foreground are several of a fleet of 30 trucks carrying dirt to the top of the dyke. In the center, right, are the Griffith Co.'s administration building and shops, which will be 60 feet under water when the basin is filled.

BUTANE ECONOMICAL AT CAJALCO

By E. E. TATTERSFIELD

President, Electric & Carburetor Engineering Company

CAJALCO Dam, the terminus reservoir of the gigantic Colorado River aqueduct, is located near Riverside, California. Seventeen months ago, the Griffith Co. in Los Angeles contracted for and started construction of this reservoir. The task proved to be one of the largest earth movement jobs of its kind in the Pacific Southwest.

E. E. TATTERSFIELD

This project consists of two main divisions and several sub-divisions, the two main divisions being Cajalco Dyke and Cajalco Dam.

Cajalco Dyke is to be an earth-filled structure 7570 feet long, 90 feet high, 600 feet at the base and tapering up to 40 feet at the top. It is surfaced on the upstream side with an 8-inch reinforced concrete slab or pavement. Each section of this slab is 18 feet, 9 inches wide and looks much like a great long white ribbon when in place. The project totals 4,113,000 cubic yards. Cajalco Dam is also to be earth filled and is 2584 feet long, 194 feet high, 1650 feet at the base and tapers up to 50 feet at the top. The upstream side of the dam is also surfaced with an 8-inch reinforced concrete facing similar to that being used on the dyke.

Upon being awarded the contract for this vast movement of earth, executives of the Griffith decided that their present equipment was inadequate and that at least 30 new motor trucks must be purchased to do the job. Mack trucks were selected and equipped with 10 yard (water level) dump bodies.

After considerable investigation and deliberation on the part of the executives of this company, butane was selected as the motor fuel to move the aggregate of 7,523,000 cubic yards of earth.

Upon arrival, each new truck was equipped with butane reglators, mixing valves and two 50-gallon butane tanks. This work was done in the shop of the Electric and Carburetor Engineering Co. and was completed in the record time of 26 days. During this installation period, the Parkhill-Wade Co. of Los Angeles completed the installation of two 7500-gallon permanent storage tanks and pressure pumping systems (25 gallons per minute) on the dam site at Cajalco.

Next, a 2600-gallon butane transport truck was constructed and put into service. This vehicle is owned and operated by the Griffith Co. The Richfield Oil Co. contracted to supply all necessary butane for the project at their Watson, Calif., refinery and spent considerable money on this refinery to be able to cope with the fuel demands of Cajalco. The haul from Watson to Cajalco is 70 miles over excellent paved highways, thus making it financially interesting to the Griffith Co. to purchase its own butane transport truck rather than to contract the fuel-haul.

On Armistice Day, 1935, the first butane powered trucks left Los Angeles for the Cajalco project. Before many days passed, all 30 trucks were delivered and put to work. Each truck has a capacity of 10 cubic yards, but due to the extra power developed by using butane as a motor fuel, an extra 3½ cubic yards were heaped on each truck, making a total of 13½ cubic yards per truck load. At this time, the job started to work three eight-hour shifts in place of two eight-hour shifts as was originally planned.

Trucks were humming, caterpillars were barking and shovels were groaning to keep

(Continued on Page 100)

Below (at left): Two 7500-gallon tanks used to store the butane at the Cajalco Dam project. At right: Several of a fleet of 30 trucks powered by butane hauling dirt to the dyke.

Philgas
DEPARTMENT
PHILLIPS PETROLEUM COMPANY
GENERAL MOTORS BLDG
DETROIT

BARTLESVILLE, OKLA. 1 WALL STREET, NEW YORK 1608 WALNUT, PHILADELPHIA EMPIRE BUILDING, MILWAUKEE

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Early in its pioneering work, Philgas adopted certain fundamental policies designed to help promote the growth of the liquefied petroleum gas industry on a sound and enduring basis. These policies have been carried out consistently and they express the spirit of the Philgas Organization.

1. To maintain highest standards of quality and to adhere rigidly to specifications, in all manufacturing operations.
2. To use, and encourage the use of, only equipment and appliances which are designed for efficient and safe use with liquefied petroleum gases.
3. To actively promote, and comply with, those safety practices and regulations which are in the best interest of the public and the industry.
4. To build and maintain an unexcelled SERVICE organization from the standpoints of raw material supply, transportation facilities, technical and engineering ability, cooperation with customers, and safe and economical utilization of liquefied petroleum gases.
5. To devote marketing activities only to those logical fields in which the use of liquefied petroleum gas is basically economical for the user.
6. To conduct continuous research toward superior equipment and appliances, and toward the development of new markets and improved marketing methods.
7. To actively cooperate with the gas industry in the common purpose of maintaining the supremacy of gas over any other source of energy for domestic and other logical purposes.
8. To cooperate wholeheartedly with other liquefied petroleum gas producers and marketers on business ethics, clean competition and the numerous other matters affecting the welfare of this growing industry.

The soundness of these policies has been proved, and the continuance of this program is assured.
We welcome your cooperation.

Philgas SERVICE

LEFT: Testing a bottled gas range for top burner thermal efficiency. RIGHT: Some water heaters used in the development of approval requirements for bottled gas appliances.

Improvements in BOTTLED GAS APPLIANCES

By W. M. COUZENS

Research Engineer
American Gas Association Testing Laboratories

THE American way of doing things certainly applies to the gas appliance branch of our industry. Each year when the annual appliance models are displayed these new and improved units are greeted with the proverbial "What Next?" New problems usually arise from the introduction of new ideas but our appliance manufacturers generally solve such difficulties before they result in service difficulties. The bottled gas appliance development is by no means an exception to this desire to overcome obstacles. The new and more efficient appliances now available for use on bottled gases, no doubt, has had considerable bearing on the successful growth of the bottled gas industry.

W. M. COUZENS

In reviewing the background of this rapid development of bottled gas appliances, it appears that the first forward step taken by the bottled gas industry was in 1928, when several large producing companies which had at that time recently entered the field, established laboratories to assist appliance manufacturers to develop more efficient appliances for bottled gas, to establish high standards of performance, to test appliances for conformance with such standards, and to improve appliance installation methods. Among the leaders in this movement were the Phillips Petroleum Co., Standard Oil Co. of California, Carbide & Carbon Chemicals Corp., Skelly Oil Co., and others. Minimum acceptable standards of performance which, in general, were considerably higher than other specifications generally known at that time for bottled gas equipment, were established and maintained. Likewise, rigid constructional standards were adopted and enforced.

The program became more definite when, late in 1931, this industry requested the American Gas Association to prepare approval requirements for common types of domestic appliances designed for operation on bottled gas. The Association agreed to this proposal and, after more than two years of investigational work on the part of the Association's Testing Laboratories the Approval Requirements Committee completed national standards for bottled gas ranges, which became effective March 1, 1933. About one year later, requirements for space heaters and water heaters were completed, and in 1935 requirements for refrigerators were also prepared.

More recently, the industry, through joint action of the National Bottled Gas Association and Compressed Gas Manufacturers' Association, made a request to the American Gas Association that it be given representation on the A.G.A. Approval Requirements Committee and its subcommittees, which were largely responsible for the technical development of those types of appliances utilizing bottled gas. This request was granted in October, 1935, and the necessary appointments to the personnel of the several committees were made immediately. On and after January 1, 1936, most of the large bottled gas distributing companies specified that appliances which they purchased must comply with the requirements of the American Gas Association. These requirements, incidentally, have been accepted by the American Standards Association as American Standards, and, therefore, are the only recognized national requirements for gas-burning appliances.

One of the most concrete examples of the benefits accruing to this co-operative endeavor on the part of the bottled gas industries with the American Gas Association has been the large increase in number of appliances available which have been tested and approved by the American Gas Association Testing Laboratories. Up to January 1, 1937, there were listed in the Directory of Approved Gas Appliances and Listed Accessories 294 gas ranges manufactured by 23 companies, 30 space heaters made by six companies, and 66 water heaters produced by 15 companies. Compared with this, on January 1, 1936 there were only 42 ranges, 15 space heaters and 20 water heaters approved and listed in this Directory.

The fact that so many different makes and types of appliances have warranted approval of the Testing Laboratories of the

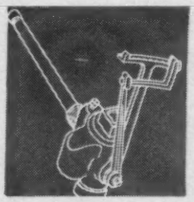
(Continued on Page 90)

Whatever gas you sell

PROPANE ★ BUTANE ★ NATURAL

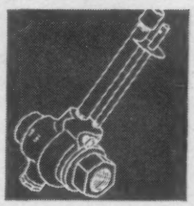
Ask us for facts about how WARD Floor Furnaces can help you win increased profit and enthusiastic approval from your consumers.

★ ★ ★



THERMO-CONTROL

Exclusive WARD features include Bilt-in Thermo-Control, the most accurate thermostat developed for floor furnaces. Part of the furnace, it contacts *all* the air passing through, regulates warmth efficiently.

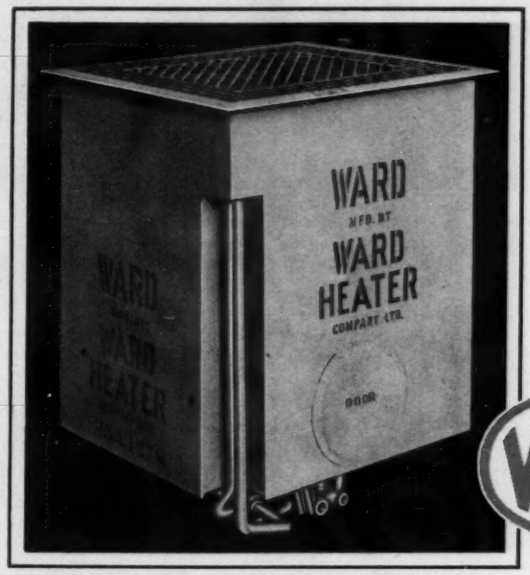


AUTOMATIC PILOT

A WARD-perfected safety device that acts promptly, is dependable and sure. Shuts off gas lines within a few seconds if flame is extinguished...burns with steady flame...consumes all the gas.

APPROVED COMPLETE

WARD FLOOR FURNACES are approved by the A.G.A. laboratories *with all accessories in* and display Blue Star Seal of Approval for *safety, efficiency, economy* in operation with Butane, Propane and Natural gases.



WARD FLOOR FURNACES are doing a grand job for distributors of Propane and Butane gases who want consumer satisfaction and increased profits from heating.

WARDS are adapted in every mechanical detail to the needs of bottled gas users. They assure efficient gas consumption and maximum heating results. No expensive accessories or costly changes. Orifice adjustments made at factory to meet requirements of your gas. Furnace comes to you in one sturdy, complete package...everything built in.

Simple to install. Just drop furnace into floor opening, hook to vent and gas line, and it's ready to go to work. All that is seen of installed furnace is handsome, durable register at floor level.

Guaranteed ten years...built to last a lifetime! More than 325,000 WARD FLOOR FURNACES in use today...giving complete consumer satisfaction with all types of gases.

Write for our new 1937 catalog, price list and complete details.

the 1937 WARD FLOOR FURNACE

WARD HEATER CO., LTD., 1800 W. WASHINGTON, LOS ANGELES

WARD REPRESENTATIVES: J. E. Davies, Peoples Gas Bldg., Chicago • A. S. Kincaid, 2012 Harwood Ave., Dallas • F. E. Reilly, 200 Davis St., San Francisco

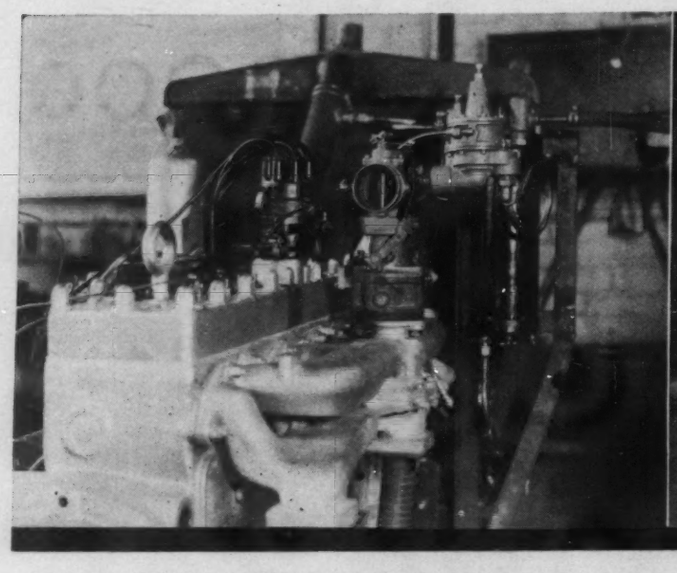


FIG. 4 (at left). Typical installation on bus engine of butane heat exchanger, pressure regulators and carbureter. FIG. 5 (at right). View of portion of machine shop devoted to engine overhauling, showing pedestals for supporting engine block during running in, and showing individual connections for water, fuel and ignition.

Spokane Bus Company Endorses Butane

(Continued from Page 49)

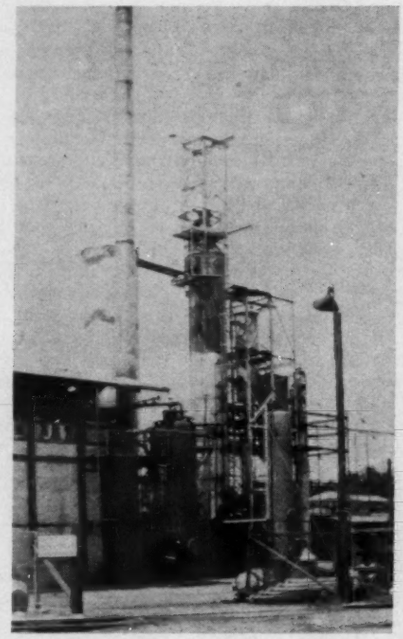
be that the motor had stopped. In order to determine if the above reasoning was correct, a bus was deliberately sent out on a run with only a few gallons in it and as could have been anticipated, there was no indication from the pressure gauge of decreasing fuel supply right up to the instant that the motor failed. It was demonstrated in actual tests that it is possible to refuel a bus on the road by connecting a tank full of butane into the liquid fuel line. For some months a 15 gallon tank was kept available in the shops for this purpose and in none of the cases, where it was necessary to use it, was any trouble experienced in transferring enough fuel into the bus tank to permit the bus to run under its own power back to the yard. Experience has shown, however, that as a matter of routine operating, it is better practice to send out another bus whenever one runs out of fuel and transfer the passengers. If proper care is used in scheduling the various types of equipment, the number of cases of insufficient fuel supply on a bus can be reduced to an almost negligible quantity.

Under normal fueling operations, the nozzle which is shown on the end of the hose in Fig. 3 is locked onto the fuel spud and thereafter fueling operations continue until the tank is full as described above. If the small valve in the loading spud on the tank fails to seat properly after the tank has been filled and after the Fisher valve has been closed, such failure will be evidenced by a slight leakage of butane around the end of the nozzle prior to its withdrawal from the loading spud. Arrangements have been provided so that in case of failure of the valve to seat when the fueling nozzle is withdrawn, the entire contents of the fuel tank can be dissipated into the air through an emergency pipe line which terminates above the top of the main storage tanks. A flexible canvas covered hose, located at the fueling spot as shown in Fig. 3, is provided with a nozzle which can be locked onto the fueling spud on the tank. The entire fuel contents of the faulty tank then discharge through the hose and underground piping into the emergency tank shown in the right foreground in Fig. 2, and dissipate into the atmosphere through the 2-inch line as shown. Even although accidents of this character should in all probability be very infrequent, it is nevertheless considered very excellent judgment to provide these emergency facilities for dissipating the liquid with safety in lieu of releasing 50 or 60 gallons of liquid butane around the bus itself and the dispensing island.

Cold Weather Problems

It was realized originally that during continued periods of sub-zero weather and also during even short periods of excessively low temperatures, the liquid temperatures in the main storage tanks and the corresponding pressures would be very low. Some apprehension was felt that if liquid fuel at these low temperatures was put into a bus fuel tank and that bus then operated all day in air temperatures which were below zero, the vapor pressure of the liquid in the bus tank might fall to a point where improper action would be obtained in the carburetor and the whole transportation system be temporarily stopped. Some consideration was given to the possibility of covering all of the tanks during the winter with some heat insulating substance or arranging to bypass the exhaust from the engine around the tank in such a way as to provide sufficient heat to raise the temperature and corresponding vapor pressure inside the tank. It was found, however, that to date at least, no such action has been necessary. Even although during the coldest weather which we have had during the past two years, the vapor pressure on the liquid as it came from the main storage tanks was less than 25 lbs., the pressure in the bus fuel tank had risen to at least 35 to 45 lbs. by the time the bus had been stored in the warm garage for four or five hours. Busses under these conditions which were in service for a full day when the lowest air temperature was —12° F. and the highest temperature —2° F. came into the garage at the end of an 18-hour run with between 30 and 35 lbs. vapor pressure. This was an equally surprising and gratifying phenomenon. It was not anticipated that any trouble would develop from excessive vapor pressures during the summer. It happened, however, that on one type of tank installation, heat from the engine as well as the surrounding air raised the vapor pressure to a point where it was impossible to pump any liquid fuel into the tank. Heroic measures were necessary to avoid crippling the whole transportation system and the perhaps crude but very effective scheme was evolved of placing wet sacking around the top of the tank and spraying it with cold water. Five or six minutes of this treatment was sufficient to reduce the vapor pressure inside the fuel tank to a point where normal fueling operations could be carried out. After considerable experimentation, this particular problem was solved very satisfactorily by making minor changes in the direction of the flow of air around the engine and the tank.

In order to reduce the time required for general overhauling of bus motors a section of the machine shop was set aside, as shown in Fig. 5. Provisions were made for running in five engines simultaneously. Refer-



Butane Production Units

View at the left shows a butane production unit designed and constructed for the Wasatch Refining Co., of Salt Lake City, Utah. The unit is designed to extract butane, iso-butane and propane from residue gases of a cracking plant. It is capable of delivering a product of from 25% propane to 75% propane content as may be desired with the balance in butanes.

The Wasatch Refining Co. unit is composed of an absorber taking residue gas at approximately 250 lbs. per sq. in.; a still operating at 100 lbs.; and stabilization equipment good for 550 lbs. working pressure.

Operating control of the unit is entirely automatic.

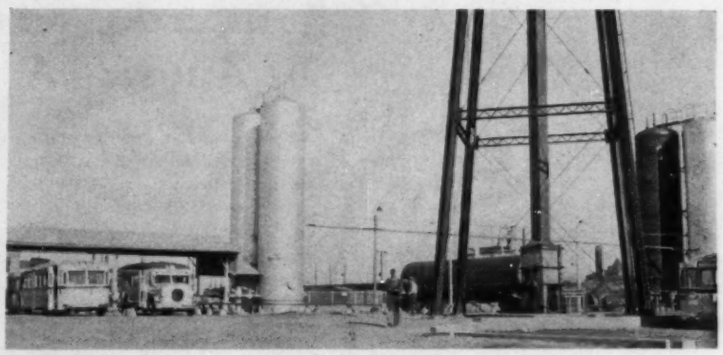
Production units of similar type in other locations are in operation recovering stabilizer overhead vapors from absorption plant sources.

Butane Storage

Storage containers for butane in sizes from 3,000 to 25,000 gallon capacity can be designed for either horizontal or vertical installation.

The storage unit in the center of this view shows two 25,000-gallon containers and the unit at the extreme right, two 12,500-gallon containers at the Spokane United Railway Co. fueling yard.

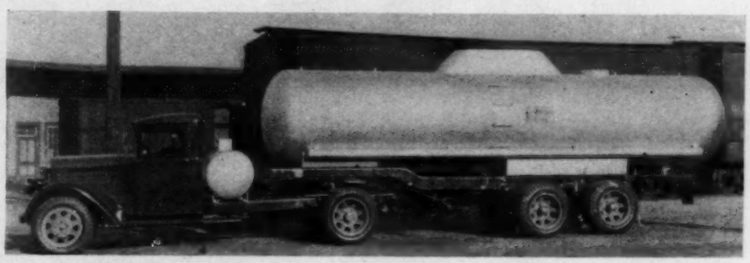
Storage units are designed for working pressures of 125 lbs. per sq. in. or more, as may be required by the product, in accordance with A. P. I.-A. S. M. E. requirements.



Butane Handling Equipment

Tank truck trailers are built in sizes from 500 to 5,000 gallon capacities for working pressures of 125 lbs. per sq. in. or more in accordance with A. P. I.-A. S. M. E. requirements and California safety orders.

All valves and connections are protected either by a steel guard welded to the tank, as illustrated, or by locating them in a depressed manhole on the top of the tank. Tanks are provided with a dump valve on the bottom, so designed that accidental damage to the dump valve shut off will not dump the load. Safety appliances comply with California safety orders.



PARKHILL-WADE, INC.
CONSULTING AND CONSTRUCTION ENGINEERS
973 NORTH MAIN STREET
LOS ANGELES

ence to Fig. 5 will show the stands upon which the complete engine unit is mounted during the idling operation. Each of the five stands is provided with its own heat exchanger and carburetor and with connections to a common supply of fuel, cooling water, electrical connections, and exhaust gas piping. The five carburetors are connected to a common fuel line which is supplied with liquid butane from a 50-gallon storage tank located outside of the wall of the building. This tank is portable and can be refilled at the main dispensing islands in the fuel yard. By means of proper valves between the 50-gallon tank and the inside fuel line, no fuel is in the line except during times when engines are being run in. With strict inspection of the valves and piping it is not thought that any undue hazard has been introduced by this method of operation. Taken as a whole, this shop procedure scheme has reduced engine maintenance costs.

Summary

There have only been two full years' operation with butane in the Spokane installation from which to draw any conclusions and admittedly insufficient experience has been gained to warrant very many positive conclusions or prophecies. Referring back to the advantages stated earlier in this article which it was anticipated would follow the complete conversion to butane, it is practically impossible as yet to determine the actual dollars and cents savings in decreased engine maintenance costs, but there is no question but what a real saving has been made. Records in the garage indicate a reduction of 60 per cent in road troubles and delays occasioned by spark plugs; connecting rod failures have been reduced at least 30 per cent; pull-ins for the entire fleet are at least 50 per cent less than they were with gasoline operation, and of course the exasperating road delays due to "vapor-lock" have been entirely eliminated. Taken as a whole, it is a liberal estimate that engine maintenance costs have been reduced by at least 30 per cent since the change from gasoline to butane. A few years ago it was customary to consider 1500 miles as the top figure before changing the oil in the crankcase—this figure has now been increased to 3000 miles. Except in a few experimental instances, the compression ratios on all the engines in the fleet have not been changed and consequently as was to have been expected, we are not obtaining as good fuel economy as we obtained formerly with gasoline. It is possible to improve the fuel economy by going to some higher ratios, say 7.5:1 or even 8.5:1, but it is not felt at this time that the saving in fuel resulting from such a change would warrant the expense of changing the heads and possibly subjecting the motors to additional internal pressures and strains which in turn might mean more of an expenditure for maintenance than would be saved in fuel. The bus drivers state that they now obtain a much smoother operation of the bus than they did with gasoline. The records in the repair garage and examinations of engines which, from time to time, are overhauled, are evidences of the truth of the statements of the bus drivers. The claim was made originally that the use of butane would result in an elimination of obnoxious gas fumes. It can be unequivocally stated that the fumes have been eliminated. The response by the riding public to this particular phase of the company's operations was instantaneous and outspokenly favorable. While no dollars and cents figure can be determined as indicative of the increased riding due to this elimination of fumes, there is no question but what a large proportion of that increase is attributable directly to the elimination of obnoxious odors.

With due regard to local municipal fire regulations regarding the storage and use of inflammable liquids, the whole problem was originally discussed at length with the Chief of the Fire Department. His grasp of the situation and his continuing assistance and cooperation have been invaluable in carrying the work to completion. The firm of Parkhill-Wade, Inc., Los Angeles, did all of the engineering and consulting work on the installation in Spokane and furnished the equipment. A great deal of the success which has been achieved to date is the direct result of the engineering advice and cooperation which they have given.

To those familiar with and engaged in the oil industry, there is nothing particularly new or involved in the equipment used in Spokane for the storing and handling of butane, but the average bus operator today can be pardoned for looking askance at the substitution of some relatively untried fuel as a substitute for gasoline. Men now in the transportation business can understand his hesitancy in venturing into a wholesale use of butane on his fleet because of some of the physical characteristics of liquefied petroleum gases. But as has been demonstrated in Spokane, the installation if properly made and properly maintained does not present any greater hazard than gasoline, and as the use of butane becomes more widespread there is no question but that improvements will be made in the facilities for handling and dispensing it. It is admitted that the Spokane installation considered as a whole, particularly with respect to the transportation end of the problem, was quite a leap into the dark and it is also true that only two years' experience has been had to date. But the operations have at least demonstrated that it is possible to use butane in a transportation system and to receive from such use the benefits heretofore referred to. With butane at competitive gasoline prices, it is felt that the capital expenditures have been justified and that gratifying returns will be made on that investment in the way of decreased operating costs, smoother operation and elimination of obnoxious fumes.

F. O. Suffron Assumes Duties As Head of Los Angeles A. G. A. Laboratory

F. O. SUFFRON, who has a full service record in the varied research and testing activities of the American Gas Association Testing Laboratories, took over supervision of the Los Angeles branch of the Laboratories early in February. He succeeds Dr. F. E. Vandaveer, who, after four years on the Pacific Coast, has returned to the Cleveland Laboratory to resume his work there as supervisor.

F. O. SUFFRON

Mr. Suffron was appointed to his Association research post in 1930. From then until 1933 he was engaged in the pipe joint research program carried on by the Laboratories, including the work on bell and spigot and mechanical joints and welding. During the course of this study Mr. Suffron made an extended trip in 1932 through the oil and natural gas fields in the Midwest and Southwest. The information obtained indicated a definite need for an instrument which could be used for the non-destructive testing of welded joints. This was later developed by Mr. Suffron and was exhibited and demonstrated at the Distribution Conference of 1933.

In December of 1933 he was appointed as head of the Research Department. During his tenure of this executive position several important research activities were brought to a successful conclusion. Among these were "The Effect of Operating Temperatures on the Combustion of Industrial Gas," "The Domestic Gas Range Research," and the "Gas vs. Electricity" investigation.

During the last several years, Mr. Suffron has been in active touch with problems relating to the mixing and utilization of gases, particularly in instances where changeovers were made from manufactured to natural gas. He has also become a well known speaker before technical groups and has presented a number of papers before the Distribution Conferences.

Among his more recent activities is the development of a flow meter for indicating gas consumption rates.

Mr. Suffron was graduated from the University of Oregon in 1915 and prior to joining the Laboratories was consulting test engineer for Smith, Emery & Co., San Francisco; distribution engineer for the Portland, Ore., Gas and Coke Co., and valuation engineer for The Washington Gas & Electric Co., Tacoma.

■ ■

Employee Suggestions Prove Helpful to Western United

Successfully operating for its eighth year, the Employee Suggestion Plan of Western United Gas & Electric Co., Aurora, Ill., furnished the company during 1936 with 301 suggestions that were adopted. More than a thousand suggestions were submitted. They covered office methods, forms and systems, meters, meter reading and regulators, cost reduction, waste prevention, buildings and grounds, public relations and courtesy, service to customers, sales of appliances and of service.

James Quarnstrom received the highest award for devising an instrument for making time run tests on demand meters.

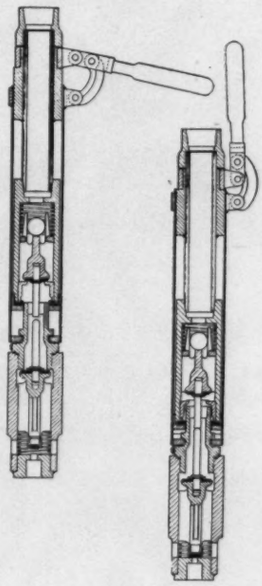
In eight years the company has adopted 431 of the 2315 suggestions submitted.

Filling Valve and Nozzle

Parkhill-Wade filling valve and nozzle is designed primarily for use with butane tanks utilizing an internal safety outage tank such as described below.

The filling valve is constructed in two main parts, the tank spud body and the hose valve. The steel tank spud body is welded directly to the tank and connected to the safety outage by ½-inch pipe. The hose valve, made of brass with an outer case and lever, is connected to the tank spud by a quarter turn about two lugs on the tank spud. The connection is made gas tight, the outage valve closed, and the liquid valve opened when the entire assembly is pressed forward by means of the lever. The mechanical advantage of the lever makes it possible to connect and disconnect the valve with a minimum of time and effort and butane loss.

Can be furnished in any length to fit any condition.

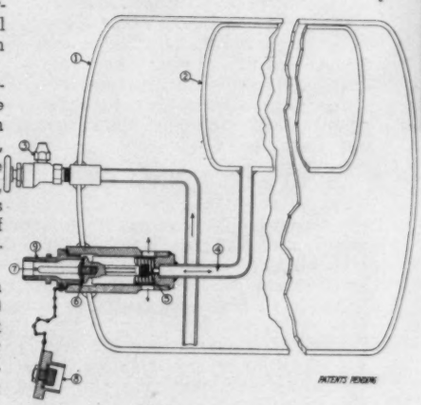


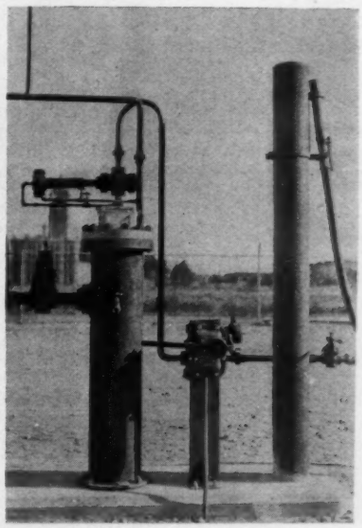
Safety Tanks

Parkhill-Wade butane safety tanks are so constructed as to automatically isolate the proper amount of space for vapor expansion. This is accomplished through the function of our filling valve which, during filling, closes off an infernal safety outage tank whose capacity exactly equals 10% of total capacity of the tank. (See illustration.) When the filling hose is removed, the filling valve automatically interconnects the internal tank with the main container.

These tanks are particularly adaptable for installation in inaccessible places, such as under the frames of busses, or in locations where venting of the container is undesirable.

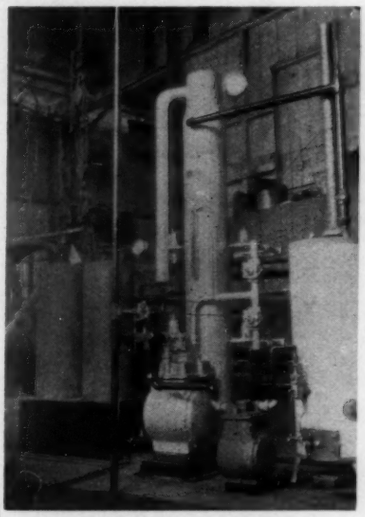
Usually ordered in sizes from 20 to 160 gallon capacity but can be built to any size desired. Comply with California safety orders.





Dispensing Equipment

The patented butane dispensing system illustrated at right consists of a pump and motor unit that sets up a 70-pound differential pressure. The assembly is then properly regulated to insure liquid at all times through a special meter and into the customer's tank. Present installations are designed to deliver from 25 to 50 gallons per minute, depending on the type of pump used. Equipped with dead-man control to guard against failure on the part of operator.



Vaporizers

Vaporizers for undiluted butane gas service in heavy domestic loads, construction camps and small town installations are designed for service capacities from 800 cu. ft. per hr. up to any desired requirement. These units are equipped with automatic control on the liquid phase and with coordinating automatic control on the vapor phase.

The vaporizer consists of a heat exchanger operating in conjunction with a hot water heater, completely vaporizing the liquid. Full tank pressure is carried on the heat exchanger up to first stage regulation at 20 lbs., with automatic vapor stage regulator set at 2 lbs. lag. Second stage regulation on both phases is set to operate at 10 to 11 inches water column as required by the system.

Operation of the vaporizer is entirely automatic and provision is made for automatically cutting off the liquid in event of failure of the hot water supply.

PARKHILL - WADE, INC.

CONSULTING AND CONSTRUCTION ENGINEERS

973 NORTH MAIN STREET

LOS ANGELES

AMERICAN METER COMPANY

INCORPORATED
Established 1836

TRADE NAMES: AMERICAN—METRIC—PACIFIC—RELIANCE—WESTCOTT

Albany, Baltimore, Birmingham, Boston, Chicago, Denver, Erie, Kansas City, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

WESTCOTT & GREIS, Inc. Dallas, Houston, Tulsa

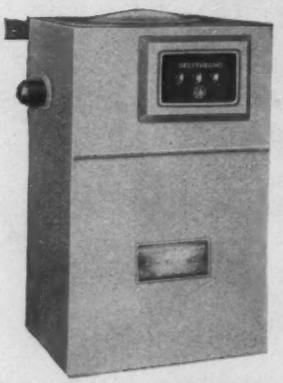
RELIANCE REGULATOR CORP. Alhambra, California

CANADIAN METER CO., Ltd. Hamilton, Ontario

PRODUCTS

Equipment for Measurement and Control of Gas, Oil, Steam, Air and Liquids.
(See also Reliance Regulator advertisement. Pages 72, 73)

LIQUEFIED PETROLEUM GAS METERS



2-B-65 Meter for Liquefied Petroleum Gases

American Meter Company provides the specialized instruments such as are essential to maintained accuracy in the measurement of Liquefied Petroleum Gases — Butane, Propane and others of similar constituency. These meters are the result of the painstaking groundwork of American Meter Company Engineers . . . with the positive efficiency check afforded by thousands of actual installations. A complete line is presented . . . meters, special indexes and regulators.

Our experience covers a century of progress in gas measurement . . . pioneering that includes practically every important advance in meter design . . . leadership —with standards of accuracy and maintenance set by the millions of our meters in general service.

American Meter Company co-operation offers not only the engineering and production service from six completely equipped plants—plus engineering contact offices in eleven more cities—but also extensive facilities for laboratory research and testing.

Special diaphragms necessary for the measurement of various gases, are the product of a continuous research program in our laboratories, to develop the best leather and oils for specific gas conditions. In every respect, these instruments for the measurement of liquefied petroleum gases are produced to meet the most exacting requirements. Write for our informative Catalog PG-4.

TINNED STEELCASE METERS

are utilized for the measurement of liquefied petroleum gases when operating pressure does not exceed 20″ water column. Meters in sizes 2-B to 10-B (see table on next page) are available for this purpose. Formula for obtaining desired meter capacity for handling any gas, appears on bottom of next page. Catalog TG-4 fully describes Tinned Steelcase Meter construction and the numerous advantages in operation.

3-B-90 Meter for Liquefied Petroleum Gases

5-B-150 Prepayment Meter with Padlock Type Coin Box

PREPAYMENT METERS

Prepayment Meters have wide use particularly in connection with the periodic utilization of liquefied petroleum gases. Our 5-B-150 Meter, standard for this purpose, is an AMERICAN B type, tinned steelcase, displacement meter equipped with Prepayment Device, specially-treated diaphragm and the special index required.

The meter operates with a 25c, 10c or 5c coin. Various price rates for the gas passed by the meter are obtained by simply installing different-sized gears, or price wheels. Price rate may readily be changed at any time.

Index C-4819—sometimes called the Acetylene Meter Index—is often specified. It is a 3 circle, 2 ft. proving head index, reading in small units, and used with single crank spiral. A special 1 ft. index, EE-11979, used with double crank spiral for 10c special meter, also is widely employed.

In ordering, it is necessary to specify the prepayment type desired, and price of gas per thousand feet at which mechanism is to operate. Specifications of all types are given in our Catalog PG-4.

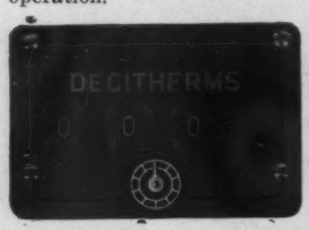
IRONCASE METERS

METRIC Ironcase Meter 5-B ordinarily is used for liquefied petroleum gas measurement when pressure is higher than 20″ water column. (See Specification Table, next page.) The necessary special indexes are available. Diaphragm leathers are specially prepared and impregnated with such oils and greases as will best meet the specific gas conditions. Inside of meter case is processed for corrosion resistance. One-piece body construction eliminates internal leaks. Many other features contribute to low-cost, efficient operation. Detailed description of Ironcase Meter construction is presented in our Catalog EG-40.

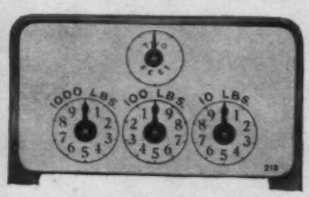
5-B Ironcase Meter with front and top removed

SPECIAL INDEXES for High Value Gases

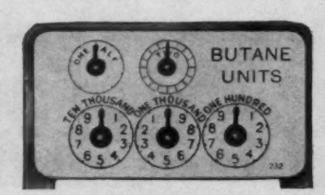
The four indexes here illustrated are among those most commonly required in measuring liquefied petroleum gases, although we can furnish indexes to meet any special requirement. The dials provide easy visibility, and at the same time maximum durability of finish. Mechanism is made to high standards of accuracy on the most modern precision equipment. The metals employed insure trouble-free operation. To supply the appropriate index, we must know the chemical constituency of the gas, the operating pressure, and the capacity in cu. ft. per hour. The indexes illustrated are designed for use on a specific meter or meters. For example, Index No. C-6919 is suited



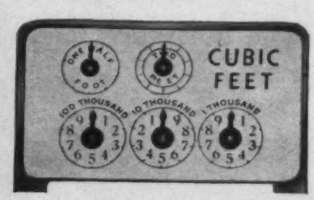
C-6919 Index



C-5642 Index



C-5368 Index



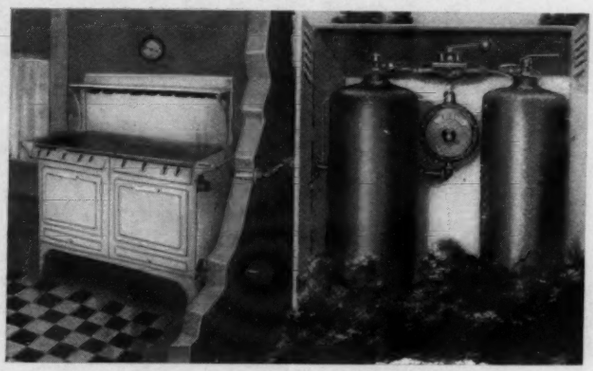
C-4239 Index

AMERICAN METER CO., Incorporated

only to the 2-B-65. There is, however, a wide choice of Dials for the particular meter in which you may be interested.

RELIANCE REGULATORS

such as Types "MR" and "MC" in reality are duplex apparatus—reducing extremely high pressures encountered in the cylinders when first installed, to a uniform outlet pressure varying from 3 to 10 pounds; thereby enabling the secondary regulator—Type "B" or "BK"—to work under normal, reasonable conditions, insuring uninterrupted service to burners or appliances. An automatic control brings the Reserve Cylinder into use whenever the Service Cylinder is exhausted—or if an increased load calls upon both cylinders to help maintain sufficient operating pressure. Reliance Regulators that are devised expressly for liquid petroleum gas control, are fully described in Bulletin 40. (See also Reliance Regulator advertisement, Pages 72 and 73).



Type "MR" Reliance Regulator employed in conjunction with "BK" Secondary Regulator

GAS TESTING APPARATUS

American Calorimeters are available in special types adapted to heating value determination of liquefied petroleum bottled gas-air mixtures. Change from the regular type is effected primarily by the substitution of a special burner tip and flame spreader. The apparatus may be obtained chromium-plated—further increasing corrosion resistance. This improved American Calorimeter is accepted as standard for B.T.U. determination, and is extensively used also to check Recording Calorimeters. For detailed description of the apparatus, write for Catalog AG-2.

PROTECTOR SIPHON GAGES

are manufactured in the Bent Glass Type and the Straight Glass Type, and are available in all required sizes. They utilize either water or mercury. Scales are graduated either for inches and tenths or for pounds and ounces. Protective shields to reduce glass breakage, can be supplied. Write for Catalog AG-5.

HIGH PRESSURE DIFFERENTIAL GAGES

All required sizes are available. Gages for use at 100 pounds pressure or above are equipped with Pyrex Glass or its equivalent. The smaller gages are of the U-type; the larger sizes, of the straight tube type. Described fully in Catalog AG-5.

WET AND DRY TEST METERS

are available in all standard sizes. The Wet Test Meters are now equipped with a new type of gage glass and water line marker—so that the water line can be set more quickly and with greater assurance of accuracy. See our Catalog AG-3.

* * *

The meters, Reliance regulators and laboratory equipment here listed represent only a small part of American Meter Company's products. Your individual specifications for pressure reducing regulators or for other types of instruments for measurement or control, will receive our prompt attention.

TINNED STEELCASE METERS

Size and Type	Rated Capacity Cubic Feet Per Hour at ½ inch loss	Connections Threaded for Iron Pipe	DIMENSIONS					Proving Circle Cubic Feet	Cubic Feet per Revolution Tangent	Net Weight Pounds
			Width to Centers of Connections	Width to Outside of Connections	Width to Outside of Caps	Height Overall	Front to Back			
2 B	65	⅜" compression fitting		9⅛"		11 31/32"	6 1/16"	1	1/20	8
3 B	90	⅜"*	10¼"	11⅝"		14¼"	8 5/16"	2	1/9	11¼
5 B	150	½"*	11¼"		12¾"	16¼"	9 9/16"	2	1/6	15¼
10 B	300	¾"	13⅜"		15¼"	18½"	11¼"	5	5/17	23

*The 3-B size may be furnished with ½" connections and the 5-B size with ¾" connections, if desired.

PREPAYMENT METERS

Model and Capacity	Height to Top of Screw	Width Overall Including Mechanism	Width Center to Center of Screws	Greatest Depth	Net Weight Pounds	Approximate Shipping Wt. Pounds	Connections Threaded for Iron Pipe
5-B-150	16¼"	15"	11¼"	9 9/16"	18½	27½	½

Model and Capacity	Prepayment Type	Range of Rates (Per Th. C.F.)	Rate Interval	Pinion Spiral	Crank Worm	INDEX		
						Type	Lowest Unit Reading	Proving Head
5-B-150	(1) Standard 25c	$0.75-$ 3.00	5c	Single Thd.	Single Thd.	Standard 3 Circle	100 ft.	2 ft.
5-B-150	(2) Special 25c	$7.50-$30.00	50c	Five Thd.	Double Thd.	Special 3 Circle	1 ft.	1 ft.

METRIC IRONCASE METERS

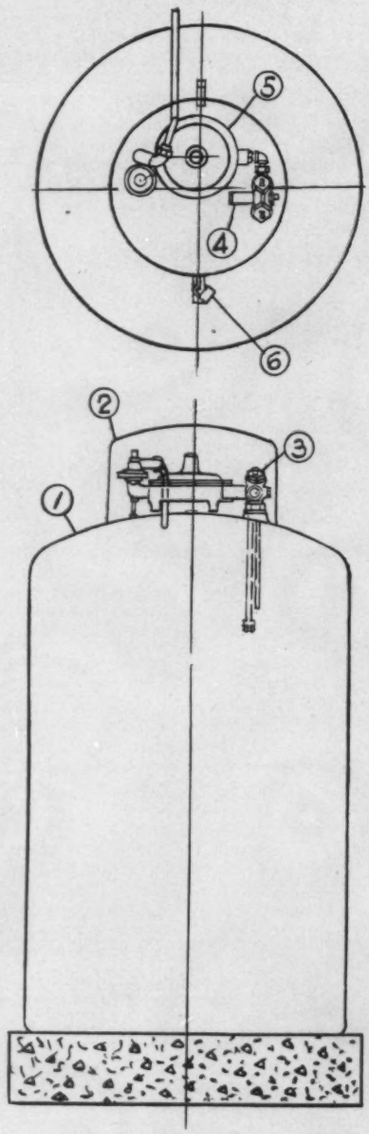
Size and Type	Maximum Working Pressure (pounds)	Type and Size of Connections	DIMENSIONS				Low Pressure Capacities (cubic feet an hour)		Type of Index	Proving Head	Teeth Axle Wheel, Front Index	Cubic Feet, per Revolution of Meter	Shipping Weight, Pounds
			Width to Centers of Connections	Height	Front to Back	Overall Width	at ½" loss	at 2" loss					
5-B	5	1" or 1¼" M. C.*	6"	14"	10"	8¾"	165	370	Front	1	9	1/9	40

*Galvanized malleable iron standard meter connections are required. Meters can be furnished for special connections on request.

Recommended operating pressure on Tinned Steelcase Meters not to exceed 20" water column; Ironcase Meters for higher pressures. Rated Capacities are based on .64 gravity gas, or 125% of air capacity. To obtain correct capacity for your gas, the following formula may be applied: Your gas capacity = Rated capacity $\times \sqrt{\frac{.64}{\text{Specific gravity of your gas}}}$

Bulk Systems

(Continued from Page 54)



LEGEND

1. ICC Cylinder
2. Cylinder cap
3. Combination filler valve, house line valve, high pressure relief valve, equipped with dip tube and vent and with back pressure valve on filler connection
4. High pressure relief valve
5. Pressure regulator with low pressure relief vent
6. Padlock

FIG. 7. Above-ground I. C. C. Tank — Commercial Propane — Batch Vaporization. No Artificial Heat.

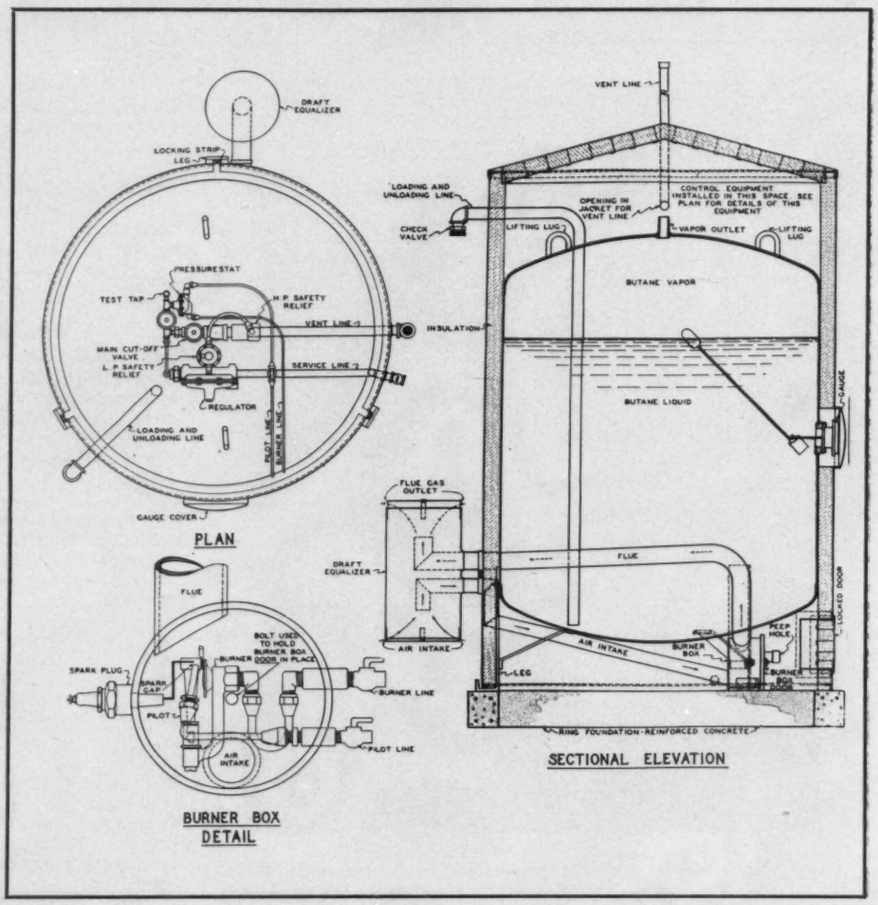


FIG. 6. Above-ground A. S. M. E. Tanks — Commercial Butane — Batch Vaporization, Artificial Heat.

able crane with chain hoist, mounted permanently on the truck, facilitates the handling and setting of the units.

As previously mentioned, the gauge reader lights the pilot in December and cuts it off in March of each year. This is done by means of an electric spark. Each unit has a spark plug installed in the burner box (see Fig. 6). In December, the gauge reader carries a "lighter" box which contains a "hot shot" battery, a coil to step up the voltage and a press button switch. It is wired in such a manner that when the box is set down on the ground one leg of the circuit is grounded, necessitating but one lead or connection to be made to complete the circuit. This connection is made to the spark plug using a battery clip. With it so connected the press button switch is held closed and the pilot-line cock opened. The spark from the spark plug electrode to pilot tip ignites the pilot gas. The burner valve is then opened and the lighter box disconnected. This method makes possible the lighting of these small flames under all weather or wind conditions and requires less time to perform the act than to describe it.

In his March round the gauge reader extinguishes the pilot and burner by merely turning off the pilot and burner cocks which are attached to the outside of the burner box (see Fig. 6).

F. Typical Above-Ground I. C. C. Tank—Commercial Propane—Batch Vaporization, No Artificial Heat (See Fig. 7):

This system is being marketed extensively in the northeastern portion of the country. The I. C. C. tank is installed permanently on a foundation at the premises of the customer and is filled periodically with liquid fuel from a truck tank.

The fuel is charged into the storage tank through a combination valve which permits the filling operation to be done without disturbing the service to the home. The gas is drawn off the cylinder through the regulator side of the combination valve; thence through a low pressure reducing regulator; thence into the house; thence through a meter. The gas is sold on a thermal basis.

All of the regulating and control equipment is mounted on the top of the cylinder and is protected against tampering by a padlocked housing, also attached to the top of the cylinder, or by a locked cabinet. Provision is made to guard against excess pressure by the insertion of a high pressure relief valve, and on the larger containers, by a fuse plug also, in either case the protective device being attached to the combination valve.

There are many patents issued and applied for covering details of construction and operation of the systems herein described.

The BASTIAN-BLESSING Company

240 EAST ONTARIO STREET CHICAGO, ILL.

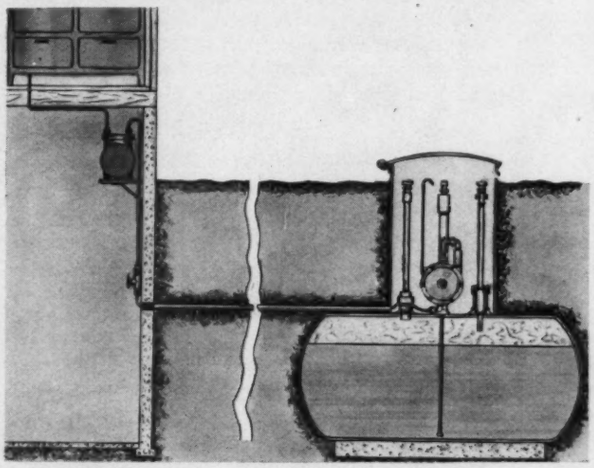
Pioneers in Equipment for Using and Controlling High Pressure Gases.

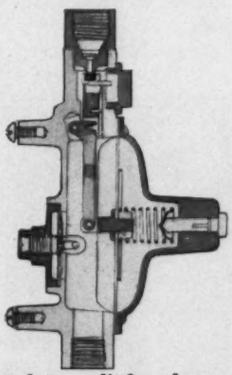
PRODUCTS

VALVES, CYLINDER
VALVES, for Propane and Butane Plants
REGULATORS, PRESSURE
OUTFITS FOR BOTTLED GAS, COMPLETE
WELDING OUTFITS, TORCHES AND REGULATORS FOR USE WITH PROPANE, BUTANE, ACETYLENE OXYGEN, ETC.

ENGINEERING AND MERCHANDISING SERVICE

Bastian-Blessing are pioneers and leaders in the manufacture of equipment for the Liquefied Petroleum Gas industry. All Rego products are designed especially to meet the specific needs of the industry as to efficiency, economy and safety. The diagrammatic illustration indicates the general application of Rego regulators, valves, fittings and controls for underground installations.

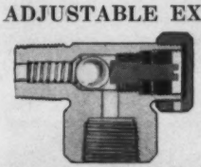




REGULATORS

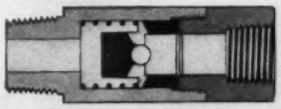
Rego regulators are designed to operate in any position and to give large capacity over the entire range of tank pressures—holding accurate and constant outlet pressures. Simple and rugged construction minimizes wear of parts. The diaphragms are made of a material which has proved its resistance to the action of gases. An important feature of these regulators is that seat replacement is easily accomplished in the field—no special tools are required. A safety relief valve, as required by the regulations, is built into the back of the regulator. This valve permits the escape of gas in the event that the regulator develops a pressure in excess of 1 lb. per square inch.

ADJUSTABLE EXCESS FLOW CHECK VALVES



These valves can be adjusted to shut off at a flow slightly in excess of normal consumption. In the event that the flow should exceed that at which the excess flow valve has been set, it will automatically stop the flow of gas. This valve can be accurately adjusted in the field, and may be used as an emergency temporary shut-off by turning the stem in all the way.

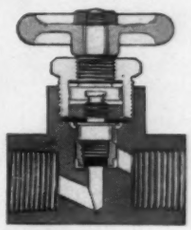
EXCESS FLOW AND BACK PRESSURE CHECK VALVES

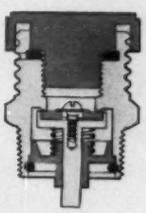


The regulations require that all connections must be protected at a point close to the storage tank with an excess flow check valve or back pressure check valve. Excess flow check valves are designed to allow a given quantity of gas to pass through in one direction, under normal conditions, but close automatically when the flow goes beyond normal. Back pressure check valves are designed to prevent a reverse flow of gases in the event such a condition should develop in the system.

LINE SHUT-OFF VALVES

The construction of this valve is such that the diaphragm is fully protected from rough handling. Channels of ample capacity minimize resistance to the flow of gases. Sturdy forged construction assures long, dependable service.



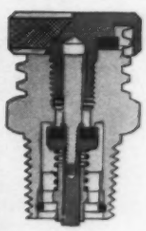


QUICK FILLER VALVES

These valves are particularly recommended for filling connections into storage tanks. The thread permits a quick connection and disconnection to the coupling and the special cap guards against any possibility of the slightest leak. The valve is so designed that it opens with the flow of gas and immediately closes when the flow of gas into the storage tank stops.

VAPOR RETURN VALVES

The function of this valve is to equalize the pressure between tank truck and tank when being filled. As soon as the coupling is removed the valve functions as a check valve and automatically closes off.



SLIP TUBE GAUGES

Rego slip tube gauges are an accurate, dependable and safe device for determining the liquid level in storage or transportation tanks containing liquefied petroleum gases such as Propane and Butane. Standard lengths are 36, 42, 54, 60, 66 and 72 inches. Special lengths will be made on order.

RELIEF VALVES

A relief valve is required on all containers in which liquefied petroleum gases are stored. The function of these valves is to relieve any dangerous pressures that might build up in the storage tanks. Rego relief valves have been designed especially for the liquefied petroleum gas industry and have proved their safety and reliability.

SPECIAL EQUIPMENT

We also manufacture a large number of special units and assemblies to meet special needs of the industry. We would be very glad to have our sales engineers go over your problems and supply you with the equipment best suited to your local conditions.

NO OBLIGATION—

to you when you send for complete catalogs describing Rego Liquefied Petroleum Gas equipment. Write for catalogs now.

POSITIVE CONTROL

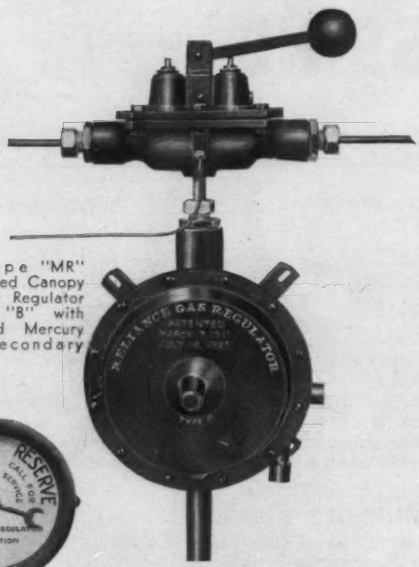


Fig. 1—Type "MR" Spring Loaded Canopy Top Primary Regulator and Type "B" with Bracket and Mercury Seal as Secondary Regulator.

Fig. 2—Indicator Dial.

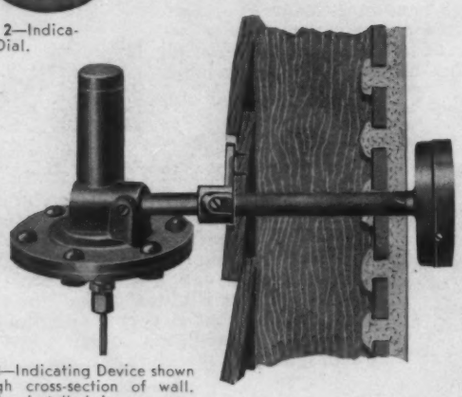


Fig. 3—Indicating Device shown through cross-section of wall. Can be installed in any convenient location.

REGULATORS YOU CAN RELY ON — RELIANCE — SINCE 1910 — TRADE MARK

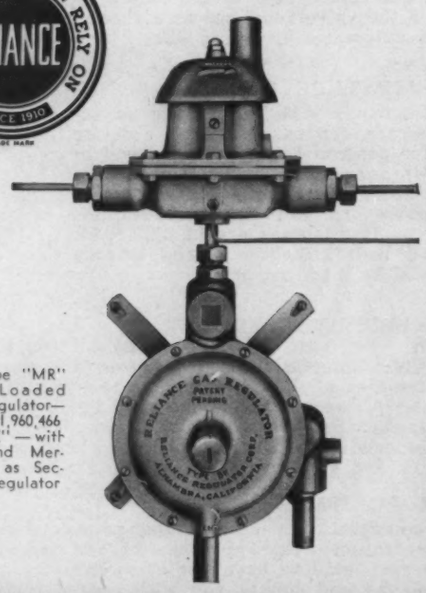


Fig. 4—Type "MR" Weight Loaded Primary Regulator—Pat. No. 1,960,466 Type "BK"—with Bracket and Mercury Seal as Secondary Regulator

The Reliance Line is Complete

Reliance manufactures a complete line of gas Regulators for Butane, Propane, Manufactured, Natural and Mixed Gases. Various types for liquid petroleum gas service have been thoroughly tested and approved by the National Board of Fire Underwriters.

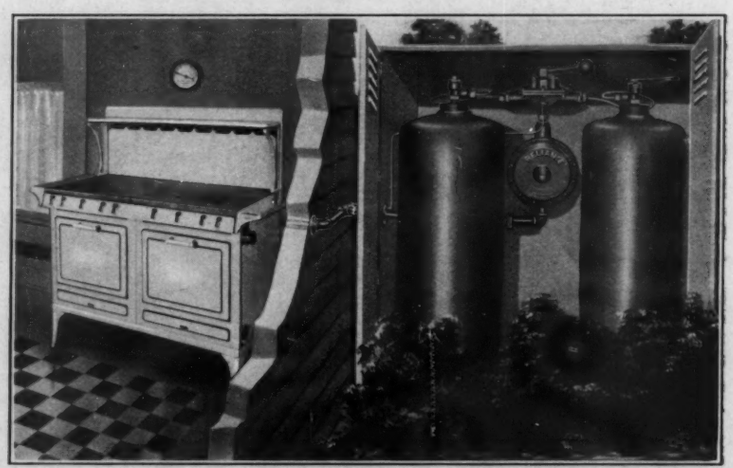
Reliance Type "MR" Regulators

Reliance Type "MR" Primary Regulators (Figs. 1-4) reduce variable cylinder pressures to a uniform outlet pressure of from three to ten pounds. When installed with two cylinders, the "MR" will automatically draw on one or both, depending upon the load and generating ability of the cylinders. (See Fig. 5) Type "MR" Regulator is usually installed in combination with Type "B" or "BK" secondary regulator, which further reduces the three to ten pounds pressure to the required inches of water pressure for proper utilization. The Type "MC" is a larger unit designed for greater capacity than is obtainable with the Type "MR."

Reliance Indicator

An indicating device (Figs. 2-3) with a movable pointer shows the customer the condition of the cylinders. When the pointer is at "Service" on the dial it shows that the reserve cylinder is standing in readiness to operate. When the service cylinder is depleted, the outlet pressure of the primary Regulator is automatically lowered, and this causes the indicator pointer to swing to "Reserve," and warns the customer to order a new supply. Reliance controls the patent (No. 1960466) on this type of equipment exclusively.

Fig. 5—Typical domestic installation of Type "MR" Regulator (Fig. 1) and indicating dial (Fig. 2) for automatic control of Bottled Gas Fuels.



RELIANCE REGULATORS

BUTANE, PROPANE AND OTHER BOTTLED GASES

Reliance Type "B" and "BK" Regulators

Reliance Type "B" and "BK" Regulators (Fig. 4) are separate units that can be used individually as single step reducing regulators, with the use of manual control valves, or as secondary regulators, as shown here, giving two-step reduction of pressures, which insures full automatic control and offers a service as constant and dependable as that of any manufactured or natural gas company.

The "BK-R" Regulator is the same as the Type "BK" unit, excepting that an internal mechanical relief valve is provided in place of the mercury seal.

These Regulators are equipped with brass inlet valves, composition valve seat discs and diaphragms, insuring long life, sensitive regulation and freedom from disturbance by high or low temperature conditions. Brackets are provided to support these Regulators and can be furnished to meet all cabinet specifications. Both of these Regulators have detachable valve seats that can be readily inspected or changed. The Type "BK" has a front handhole plug through which the valve mechanism can be inspected or changed, eliminating the necessity of breaking inlet connections.

Our standard type mercury seal insures positive relief with minimum hazard of loss of mercury, while the collector type seal practically eliminates all possibility of mercury loss and reseals after a momentary blow. Detail is shown in Fig. 6.

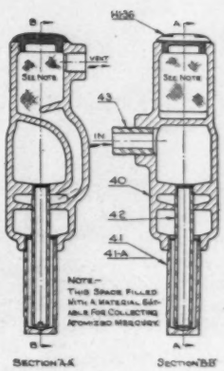


Fig. 6 — Section of Special Collector Type Mercury Seal.

Reliance Type "H" Regulators

This type is specially adaptable for Butane and Propane distribution systems. More uniform control of flowing pressures and a lower lockup pressure are available in the Type "H" than in any other regulator of the same size and type. Expansion pressures do not affect the diaphragm operation. The special toggle action permits a longer and more powerful thrust to be exerted on the valve seat. The Type "H" is furnished in either the dead weight or spring loaded types. Mercury seals are optional. Valve orifices and valve seats may be removed or sizes changed without disassembling the Regulator. Valve seat discs are supplied in either leather or composition. Straight coil adjusting springs assure any outlet pressure desired between 3" and 14" water pressure. The adjusting screw plug may be sealed to prevent tampering with the adjustment.

Fig. 7—Reliance Type "H" Service Regulators are used extensively in Butane-Propane Air Mixed systems and on distribution of pure vapor, giving satisfactory service at all times with a minimum amount of expense. Patent No. 1931777.

Details, illustrated Bulletins and prices will be furnished promptly on application to our nearest office.

RELIANCE REGULATOR CORPORATION

1000 Meridian Ave., Alhambra, Calif.

American Meter Co., 60 East 42nd St., New York City

RELIANCE REGULATORS

Butane Engine Drilling In the Midcontinent

By H. W. HARTS

General Superintendent, Natural Gasoline Corporation, Tulsa, Oklahoma

WHAT is said to be the first well drilled in the Midcontinent area using butane as fuel was Amarada Petroleum Corp. Travelers No. 1, located in the SE¼ 28--15n-9e, Coal County, Okla.. Since this well was drilled, a number of contractors have adapted their drilling rigs to butane. The Amarada well was spudded in on June 10, 1936, and completed at a depth of 5416 feet on August 13, 1936. Creekmore Drilling Co., the contractors, used a V-belt driven machine powered by two 300-horsepower Waukesha engines with a single slush pump.

The application of butane for drilling purposes may be more aptly illustrated by the following discussion on the subject.

THIS article is not for engineers, nor for chemists, but merely a discussion of the use of butane as a fuel between ourselves and Mr. John Driller. Butane, when utilized as a fuel, is manufactured to give the best results for the use to which it is put, and for that reason is ordinarily not pure butane, but contains some of its wilder brother, propane.

Butane can be considered as the next higher cut from crude oil above the gasoline used in motor cars. Just as gasoline evaporates more easily and quickly than fuel oil, butane evaporates that much more easily and quickly than gasoline. In fact, it evaporates and entirely boils away at any temperature above that at which water freezes. For this reason, should we put butane in a closed container so that it cannot evaporate or boil, then it exerts a certain pressure on the container in its effort to escape. It is this pressure which makes it a desirable fuel for gas engines, for it can be made as a liquid, stored as a liquid, transported as a liquid and then used in the gas engine as a gas by merely reducing the pressure. The average pressure under which this fuel is handled is 35 or 40 lbs. regardless of temperature. This uniform pressure is maintained throughout the year by the difference in the manufacture of the product.

Butane is hauled in specially designed tank wagons, as shown in Fig. 2, usually having a capacity of 1100 or 2200 gallons. These tank wagons must have a working pressure of 150 lbs. and be equipped with suitable relief valves and measuring devices for determining the liquid level in the tank. Ordinarily, two horizontal cylindrical tanks are used, approximately 40 inches in diameter, and whatever length is desired, depending upon whether a truck and trailer are used, or merely a truck for transportation.

Should the butane be desired on a drilling well, a storage tank of sufficient working pressure is first installed approximately 150 feet from the location, and as high above the engines as possible. The tank is usually of 8000 gallons capacity so that drilling may be continued during inclement weather when travel to the location may be impossible. This tank is connected to the engine, or engines, at the well by a 2-inch line, and a manifold connection on the storage tank should come from both the bottom and the top of the tank. The top connection is gas, and used for starting. After the engines are warmed up, the top connection is closed and the bottom connection opened. A series of pressure reducing valves are installed near the engines, one a ½-inch motor valve for handling of liquid, and the other a 1-inch pressure reducing valve for handling of vapors. The pressure on the low side of these valves should be maintained at from 3 to 6 lbs. In making this reduction in pressure, there is a corresponding reduction in temperature which takes place principally when the liquid changes to a gas. This low temperature may be somewhat lower than the freezing point of water, and for that reason, a small heat exchanger is installed just below the reducing valves. The heating of the vapors is accomplished by a ½-inch line leading from the radiators of one or both of the engines and returning to the engine water pump. Thus, not only is the gas heated, but the engine jacket water is cooled. A small copper tube connected to the hot water lines is wound around the motor valve body to prevent freezing, and a small amount of asbestos used to cover the tubing to retain the heat. Should an ice box be desired, a ¼-inch brass coil can be installed, bypassing the regulator and running through a barrel or box. In the past, especially in the summer months, this has proved a popular innovation with the drilling crew.

After the vapors are heated, they pass through a small house regulator into a volume tank similar to those used on any gas engine. These are usually pup joints of 12-inch pipe, about 18 or 20 feet in length,

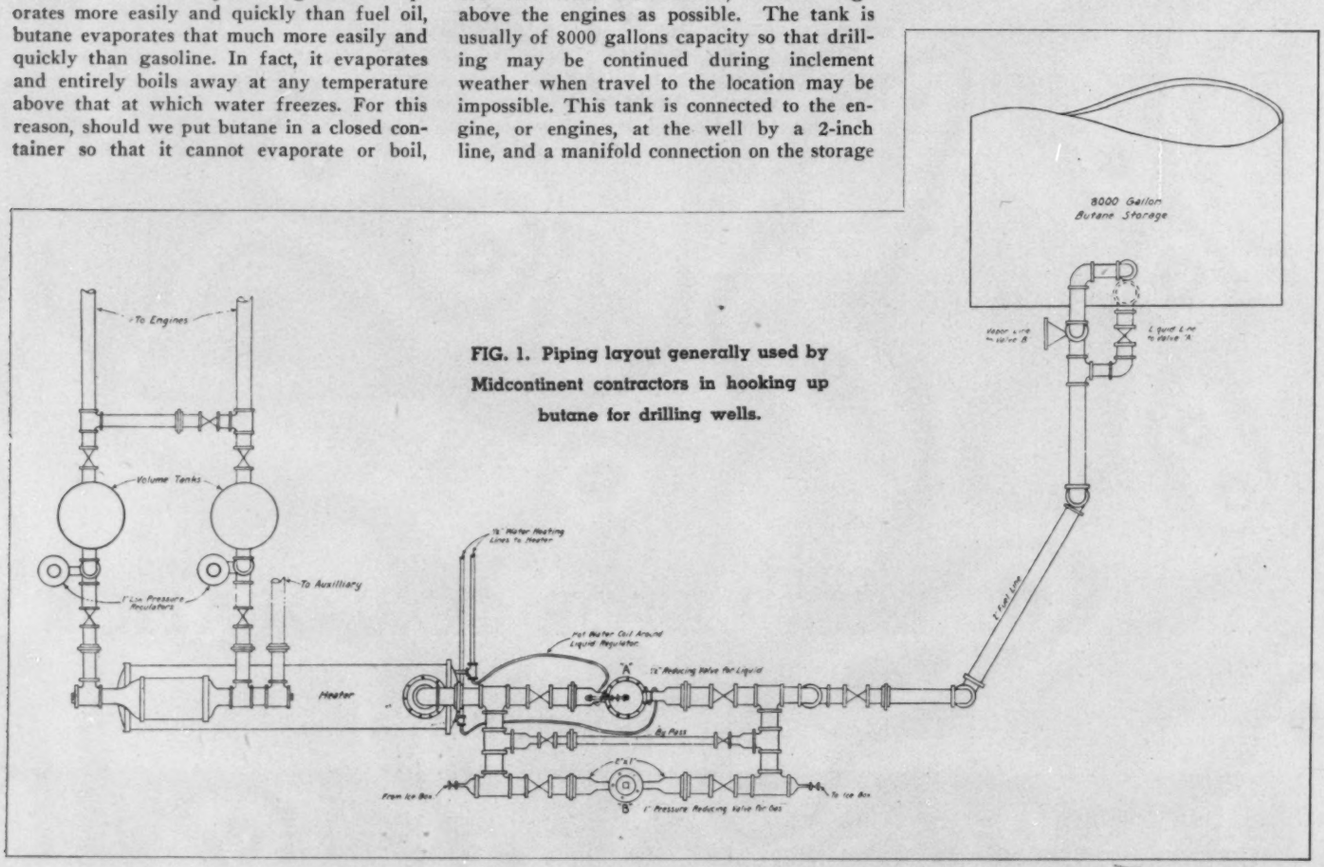


FIG. 1. Piping layout generally used by Midcontinent contractors in hooking up butane for drilling wells.

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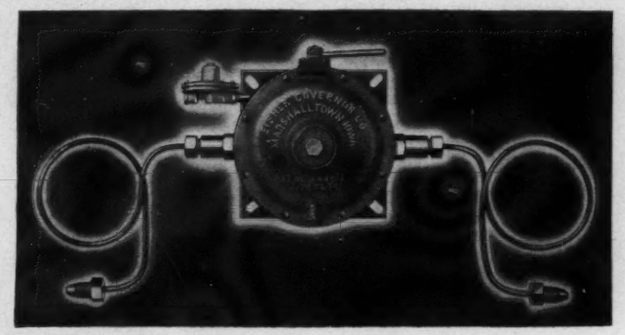
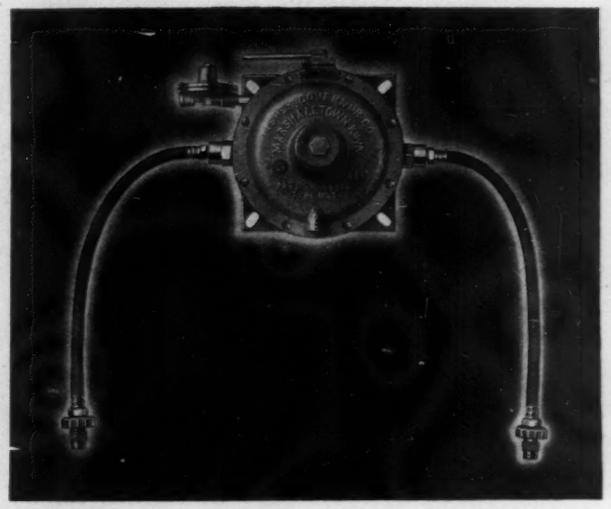


Shown above is the Famous Fisher Type 741C Two-Drum Regulator, which has the change-over mechanism built integrally in the regulator. No high pressure manifold or cross-tee, consequently eliminating several high pressure joints and potential points of leakage. The most simple, fool-proof, positive operating regulator for your major two-drum systems available on the market today.



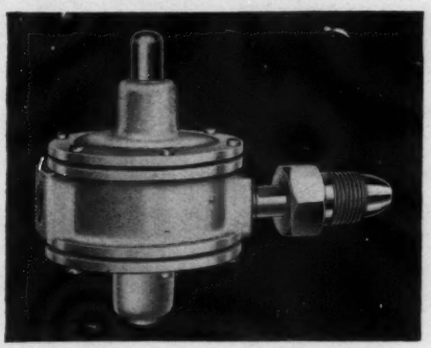
The improved Type 741E Regulator Assembly is shown above, and in this unit the copper tubes or pigtail connections have been replaced with the new Fisher Flexaprene Hoses, which are easily connected to the cylinder valves without the aid of wrenches. This is an outstanding development that your customers will appreciate. Write for complete details on the new Fisher Flexaprene Hoses.

FISHER

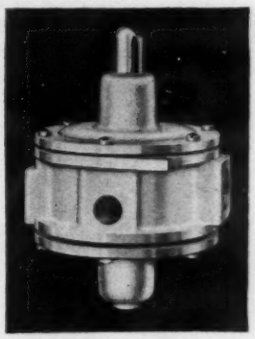
The Fisher Governor Company manufactures a very complete line of bottled gas and liquefied petroleum gas regulators and various types of canopy assemblies.

●

Complete information will be gladly furnished you, as well as any other engineering assistance you may require, without obligation to you.



Illustrated above is the Fisher Type 713, small, compact, all die cast regulator which has a relief valve built integrally with it. Suitable for all domestic Propane installations, and as shown, is fitted with a POL connection intended to screw directly into the cylinder valve. Several variations of connections are available with this regulator, enabling it to be used for single or two-drum installations under virtually all types of operating conditions.



The Type 712 All Die Cast Self-Contained Pressure Reducing and Relief Valve, is similar to the unit shown at the left. Furnished with ¼" pipe thread inlet connections, ⅜" outlet connections. The relief valve vent is shown at the side of the regulator in the above illustration. The net weight of this regulator is approximately 1 lb., yet it has ample capacity for the average domestic installation, and there are now thousands of these in service, operating under virtually all atmospheric conditions, giving excellent control.

Fisher Governor Company

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REPRESENTATIVES IN EVERY PRINCIPAL CITY

FIG. 2 (left). Gas engine equipped to use butane as fuel for drilling. A flexible hose connected to a combination carburetor carries the vapors from the reduction valves to the engine. FIG. 3 (right). Tank trucks equipped to transport butane to the field from production plants.

laid horizontally immediately below the engines. A 1-inch Reliance regulator can be used for pressure reduction at this point and gives very satisfactory results down to ¾ of an ounce, which is the desired pressure to be held on the volume tank. If a separate volume tank is installed for each engine, it should be approximately 10 feet long, and each will require a low pressure regulator. When one large volume tank is used, a 2-inch line connects this tank to each engine, and another to the auxiliary plant. Often a small butane storage tank, approximately 3 feet by 7 feet, is installed at the water station to operate the engines furnishing the water supply. From time to time, a portion of the butane truck's load of fuel is saved to keep this tank filled.

A majority of the new gas engines are being equipped with combination carburetors and butane mixing valves. These mixing valves are equipped with the final low pressure regulator, and with their installation, the pressure on the volume tank can be held at any point up to 6 ounces.

When estimating the amount of fuel necessary for drilling a well, we can figure roughly that if two 300-horsepower gas engines are used, the consumption will begin at about 400 gallons and gradually increase to 1000 gallons daily. If two 225-horsepower gas engines are used, the maximum daily consumption will amount to approximately 800 gallons. Inasmuch as butane gas is more than three times as hot as natural gas, it requires only one third as much volume of vapors as it would if natural gas were used. One gallon of butane will evaporate, creating 32 cu. ft. of vapors, which will be equivalent to 100 cu. ft. of natural gas, and following the same reasoning, the power derived from 1000 cu. ft. of natural gas would require 10 gallons of butane. For practical purposes, we can estimate the consumption of fuel in a gas engine at 10 cubic feet per hp. hr. in terms of natural gas. Therefore, hp.x24x10 will give the amount of natural gas required per day, and butane requirements can be computed. Fig. 3 is a graph showing the comparison between butane and natural gas for various horsepower gas engines.

One of the difficulties encountered by contractors who use butane as a fuel is that of vapor pressure. During the summer months when the thermometer stands above 100° F. the excess pressure is quite troublesome, due to the fact that some of the manufacturers of this product do not fractionate close enough, and permit too much propane to be condensed with the butane. During the winter, the reverse is found to be quite prevalent, because not enough propane is included to lower the initial boiling point so that the liquid will flash to a vapor as it is released through the reducing valves into the volume tanks. Some of the manufacturers of natural gasoline who furnish butane for drilling purposes pay particular attention to the weather where it is to be used, and manufacture it so that these difficulties are not encountered. Perhaps, as it is used more generally, butane will be prepared with a standard specification so that vaporization can be obtained during any month of the year without excessive pressure in the summer, and the lack of it during sub-freezing weather in the wintertime. However, with several thousand gallons of the fuel in the field, stored in the working tank at the well, it would be practically impossible to gauge the weather accurately, when radical and sudden changes in temperature occur. Some of the contractors are overcoming the obstacle of vapor pressure, during periods of extremely cold weather, by installing a pilot flame under the liquid line between the supply tank and the regulators, which, in normal instances provide sufficient evaporation to maintain an adequate working pressure upon the vessels in which the butane liquid is stored.

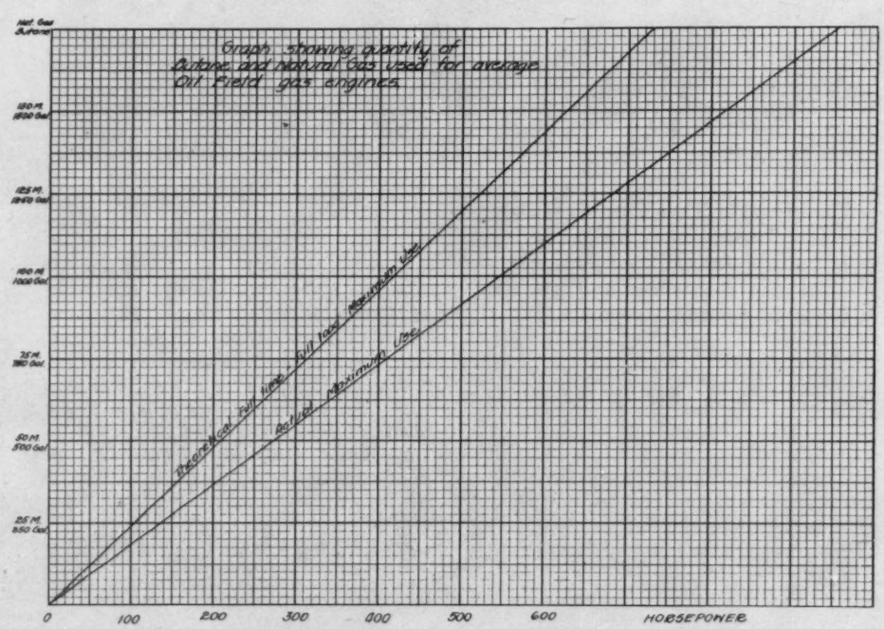

FIG. 4. Graph showing quantity of butane and natural gas used for average oil field gas engines.

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Containers for Gases, Liquids and Solids

The Combination Central Plant

(Continued from Page 46)

(5) high volumetric efficiency, (6) low fuel cost, (7) little or no crank-case dilution, (8) little or no carbon deposits in cylinders or on rings, (9) improved idling characteristics, (10) accurate proportioning of air and fuel charges, (11) elimination of manifold distribution problem, (12) highest B.t.u. value per pound of any commercial liquid fuel, (13) does not change or deteriorate in storage, and (14) fuel may be used for purposes other than operating internal combustion engines.

In their applications to the generation of electricity for small city power stations, liquefied petroleum gases operate much the same as natural gas, which is being used as fuel for this purpose in a great many installations in the United States at the present time. The combustion characteristics of liquefied petroleum gases are practically the same as those of natural gas. In the generation of electricity, the principal fuels to be considered are gas (liquefied petroleum gases where natural gas is not available), Diesel oil and steam. Where steam is used, it must in turn be generated by some fuel, either coal, oil or gas. For towns of 2500 to 5000 population, the use of steam for electric generation is now generally out of the question, because of the high investment required. This, then, generally leaves the choice between gas engines or Diesel engines. The Diesel engine has a very high thermal efficiency, due to its high compression ratio. To offset this fact, the final cost per gallon at point of delivery is about the same as that of propane, but the handling charges are higher. One gallon of fuel oil contains approximately 140,000 B.t.u. At 6 cents per gallon delivered to the engine cylinder, this is the equivalent of 42 cents per M cu. ft. of 1000 B.t.u. natural gas. This would be an average rate for fuel oil in the quantities required for plants of this type.

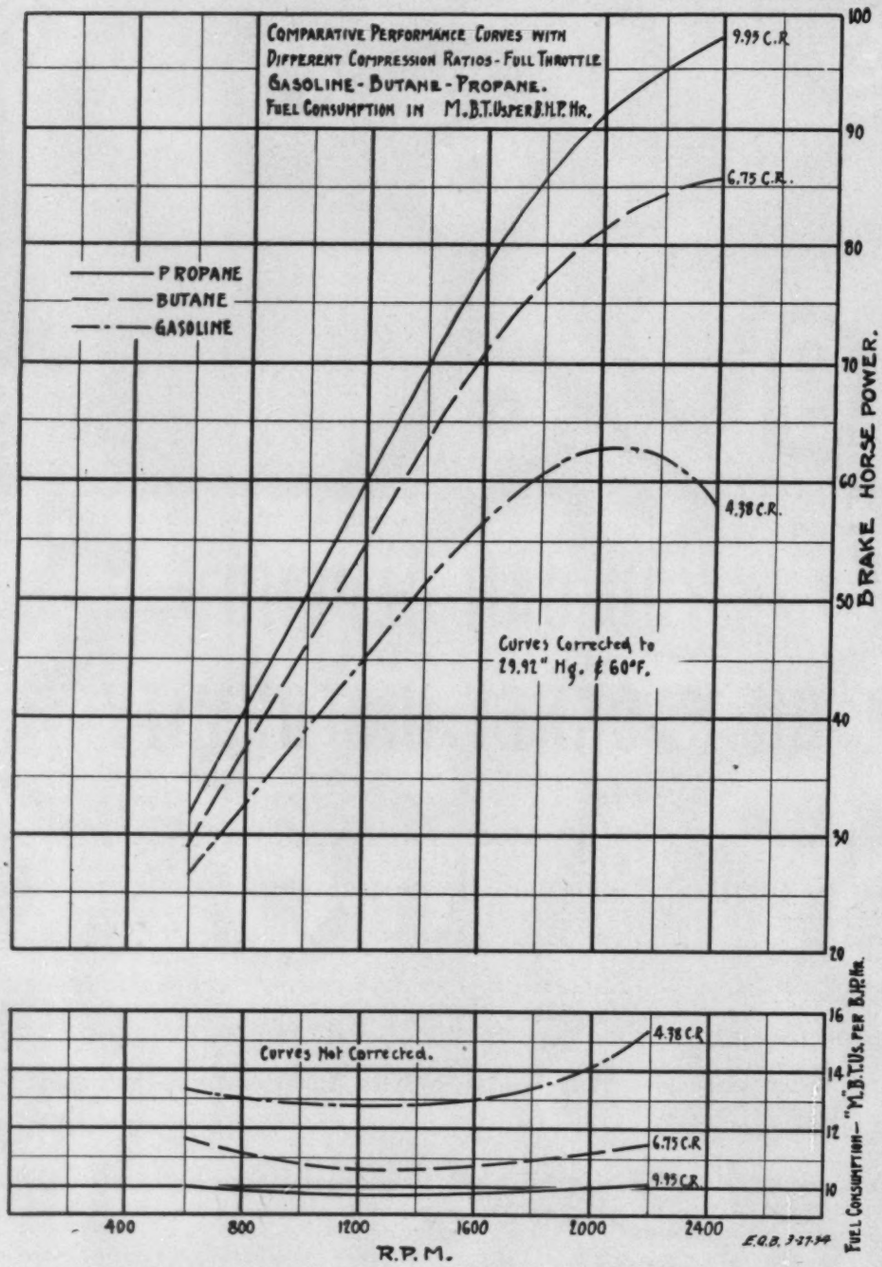


FIG. 3. Comparative performance curves with different compression ratios—full throttle, gasoline—butane—propane. Fuel consumption in thousands of B.t.u.'s per brake horsepower hour.

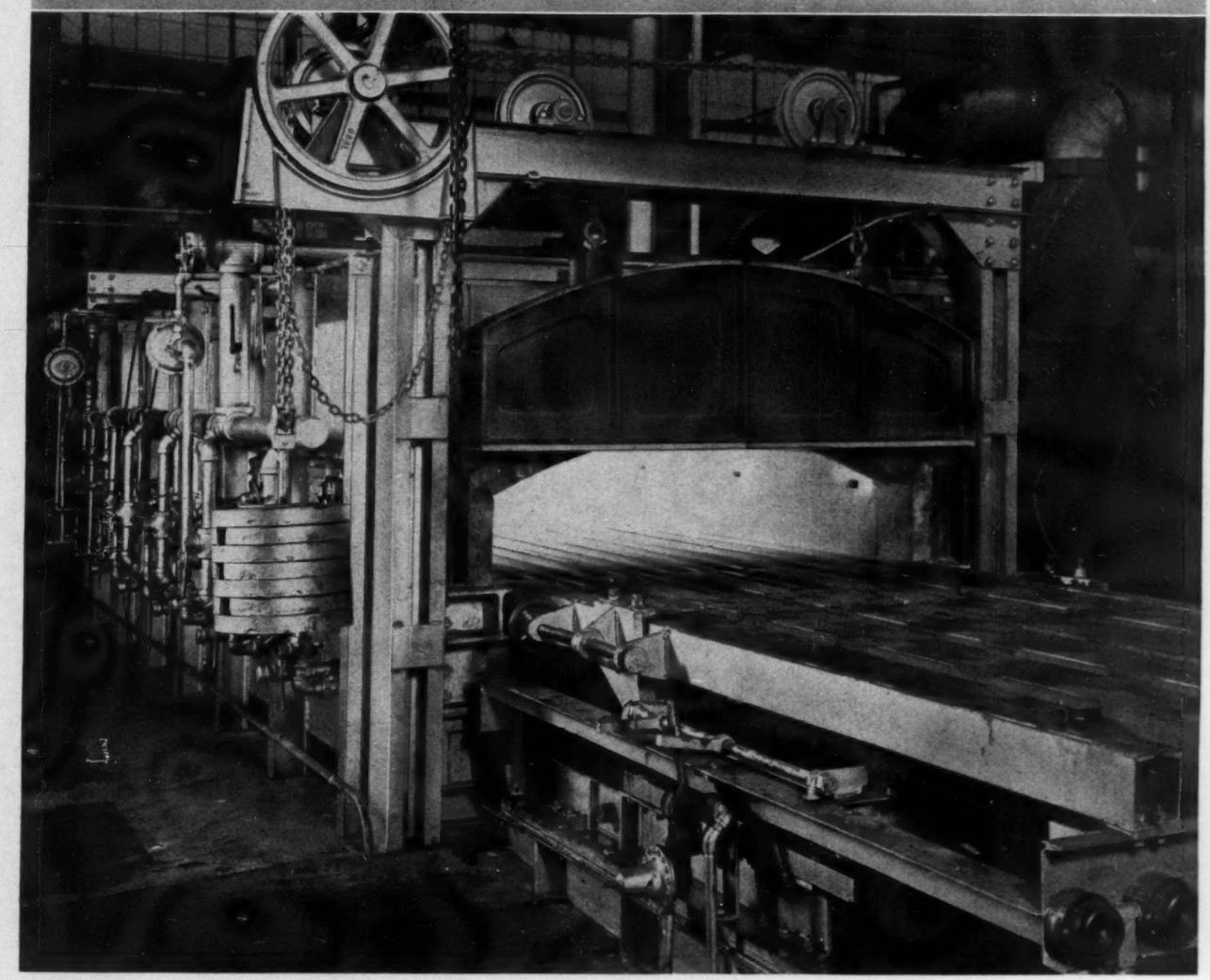
Because of the high cylinder pressure, the Diesel engine is heavier and consequently more costly than the gas engine. Maintenance expense is somewhat higher. The services of a high grade engineer are usually necessary for Diesel operation, as this type of engine is generally conceded to be more complicated in operation. Propane is nearly constant in its properties, while Diesel fuel can vary to a great degree, from one lot to the next, and in various localities. It has been found at times that only a slight variation in the oil can cause marked changes in the operation of the engine. With fuel costs per gallon equal, the total cost of operating propane engines in a plant of the capacity and load considered here will generally be under that of a Diesel plant of the same capacity and load.

A number of engine manufacturers are building internal combustion engines suitable for efficient operation with propane and butane in conjunction with electric generator sets, direct-connected refrigeration compressors or pumps, or for various other industrial power purposes. These engines vary in type, size, speed and in hp. output, so that the proper selection of suitable and readily available units for the particular conditions and load involved presents no problem. Generally speaking, the lower the speed of the generator, the higher the cost for any given size, with a decrease in cost per kw. as the size of the unit is enlarged. The lower speed internal combustion engines generally cost more per hp., with lower figures for the higher speed engines. The lower speed equipment may be subject to lower maintenance charges and is more suitable for continuous day-in day-out full load operation.

Table No. 3 presents a summary of costs of internal combustion engines and electric generating equipment, the figures presented being obtained from information furnished by a number of prominent equipment manufacturers. Table No. 4 gives data on total plant investment costs of Diesel and gas engine generating plants as taken from the 1927 Proceedings of the National Electric Light Association, Prime Mover Committee Report. Since the replacement of the N.E.L.A. by the Edison Electric Institute, similar published data have not been available. Gas engine costs at this time are about the same. Diesel engine costs have been reduced somewhat due to intensive competition between manufacturers, but are still higher than those of gas engines.

Average maintenance charges on the lower

FOR BUTANE OR PROPANE SC MEETS THE NEED



● Butane gas of 3200 Btu and 6" water pressure is the fuel employed for this SC walking beam furnace used for normalizing brake drums weighing 12 lbs. each. Production is 3000 lbs. per hour with a gas consumption of 750 cu. ft. per hour. This corresponds with a gas consumption of ¾ of one cu. ft. per lb. and represents a gross thermal efficiency of 43%.

Surface Combustion offers many years of experience in obtaining the most efficient fuel utilization whether the gas used is natural, manufactured, Butane or Propane or any combination of them, and provides for the variety of applications demanded with 47 types and more than 400 sizes of burners.

There is an SC furnace for every kind of heat treating operation, from small batch type ovens to the largest continuous atmosphere furnaces and steel mill slab heaters. Existing furnaces can be easily equipped with SC automatic proportioning one valve control burner equipment for high or low pressure gas of any mixture. Call in an SC Engineer on your problem for the correct solution. Additional information on request.

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TABLE NO. 4. COMPARATIVE INVESTMENT COSTS PER KW. OF OIL AND GAS ENGINE ELECTRIC PLANTS, 1927 PROCEEDINGS N.E.L.A PRIME MOVER COMMITTEE REPORT

	Diesel Engines					Gas Engines		
KW CAPACITY INSTALLED	3500	1000	200	400	240	2450	1010	1360
Engines	$ 88.60	$ 97.50	$ 98.30	$ 93.30	$ 89.50	$ 87.80	$ 59.40	$ 58.80
Generators	20.00	11.00				13.40	10.40	12.90
All Equipment	129.90	138.90	174.32	132.99	108.83	118.00	99.00	121.50
Foundations	8.60	10.00	56.00	45.20		3.30	4.00	4.40
Buildings and Sidings	11.60	30.00				4.90	14.90	16.90
Total Before Overhead	167.40	200.20	303.49	224.65	144.74	146.00	132.00	168.00
Total With Overhead	196.00	234.00	313.00	240.00	156.00	167.00	151.00	188.00

TABLE NO. 5. COST PER KW. USING PROPANE FUELED GAS ENGINES
(Depreciation and Interest on Investment Not Included)

	500 kw. Capacity				1000 kw. Capacity			
	Load Factor				Load Factor			
	50	60	70	80	50	60	70	80
Kilowats	250	300	350	400	500	600	700	800
Total kw. Generated 24 Hours	6,000	7,200	8,400	9,600	12,000	14,400	16,800	19,200
B.t.u. per kw.	19,500	18,000	16,950	16,200	19,500	18,000	16,950	16,200
Total B.t.u. Consumption per day	117,000,000	129,600,000	142,380,000	155,520,000	234,000,000	259,200,000	284,760,000	311,040,000
Gallons Propane per day	1,279	1,416	1,556	1,700	2,557	2,833	3,112	3,400
Propane Cost at 6c per Gal.	$ 76.80	$ 85.00	$93.35	$102.00	$153.40	$170.00	$186.70	$204.00
Lubrication Cost per Day	.80	.85	.90	.95	1.60	1.70	1.80	1.90
Labor Costs, Three Shifts	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Maintenance Cost per Day	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00
TOTAL Cost	$ 93.60	$101.85	$110.25	$118.95	$172.00	$178.70	$205.50	$222.90
Operating Costs per kw. hr. Generated—Cents	1.56	1.41	1.31	1.24	1.43	1.24	1.22	1.16

speed engines in the power ranges listed in Table No. 4 run approximately $0.80 to $1.10 per hp. per year. Lubrication costs range between $1.00 and $2.00 per year per hp., depending upon whether 12-hour or 24-hour service is maintained, and varying, naturally, with the age of the equipment and whether or not lubricating oil is reclaimed.

The modern 4-cycle gas engine is guaranteed to produce at full load one bhp. hr. on a fuel consumption of 10,000 B.t.u. with either natural gas or propane. Guaranteed fuel consumption at other loadings is shown in Fig. 4. In some calculations in this report an engine load factor of 60 per cent is used which would require 12,000 B.t.u. per hp. hr. While the use of a 60 per cent load factor may at first glance seem high, it must be remembered that in this combination plant, the prime movers are to be divided into several units, connected so they can handle various power requirements in the plant and therefore be running all of the time at a higher load factor than would be possible in almost any other type of installation. The efficiency of the gas engine does not depend upon the size of the unit. The smaller engine can be just as efficient as a large one. In arriving at a propane consumption per kw. hr. generated, the fuel consumption per bhp. of engine is multiplied by 1.5. This factor is arrived at by using the factor 1.34, the relationship of electrical kw. hr. to mechanical hp. hr. and a 90 per cent efficiency for the generator. Thus at 60 per cent of full load on the engine, the fuel consumption will be 18,000 B.t.u. per kw. hr. generated.

In Table No. 5 are presented the calculated costs of generating electric power with propane fueled engines based on the above lubrication, maintenance and labor costs and assuming delivered costs of propane at 6 cents per gallon. These costs do not include depreciation and interest on investment. These figures should be revised for other propane prices.

To arrive at a comparable cost per kw. hr. using Diesel engines, reference is made to the 1933 report of the A.S.M.E. Sub-Committee on Oil-Engine Power Costs, Oil and Gas Power Division. The report of this Committee for 1933 is presented in the February 1935 issue of the Transactions of the A.S.M.E. From the plants on which data are given in this report, have been selected a considerable number having approximately the same size and yearly output of electricity, as the plant being considered here. This report gives the total production cost per kw. hr. of each of the plants, not including depreciation or interest on investment. In making calculations, the production costs thus given are averaged, and corrected for various fuel prices as shown in Table No. 6. Table No. 7 presents further data on Diesel engine electric generation costs taken from plant records.

Water and Sewage Pumping Equipment

As a general rule, the pumping equipment for the town's water supply can also be located in the central plant, and sometimes sewage pumping can be located here. Even if necessary to locate these pumps at other places, they can readily be operated with gas from the distribution system and with remote control, if desired.

Two methods of pumping are possible for water works purposes. One is that of pumping into some form of storage reservoir; the other continuous direct pumping, in which the pump is operated at a speed just sufficient to supply the demand for water. Due to its flexibility and factor of safety the former method is that ordinarily used, and is the only one considered herein. Where water is pumped into a reservoir, the pump can be run at full load during periods necessary to replenish the reservoir supply.

In the central plant being discussed, there are two possible methods for driving water pumps; (1) by internal combustion engines direct-connected to the pumps and operated with propane, (2) by motor driven pumps, the current for the motor being furnished by the electric plant already discussed, this electricity being in turn generated by means of propane-driven engines.

Wherever possible, it is most desirable to operate the pumps with direct-driven propane-fueled engines, since the efficiency

REYNOLDS GAS REGULATOR CO.
ANDERSON. INDIANA.

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High Pressure Liquefied Gas Regulators—Especially Designed and Built for the BUTANE-PROPANE Field

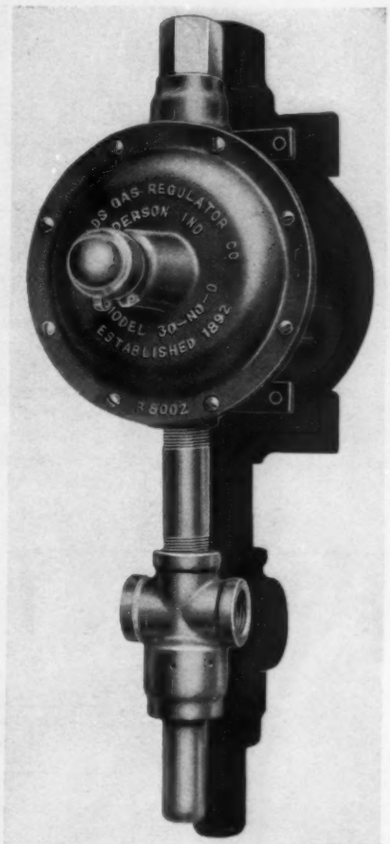
REYNOLDS Model 30 Little Giant Type Liquefied Gas Regulators are small, compact units for use on high pressure liquefied gas sets. R-8000-B 2 of this model (illustrated) is for installation where maximum demands will not exceed domestic use.

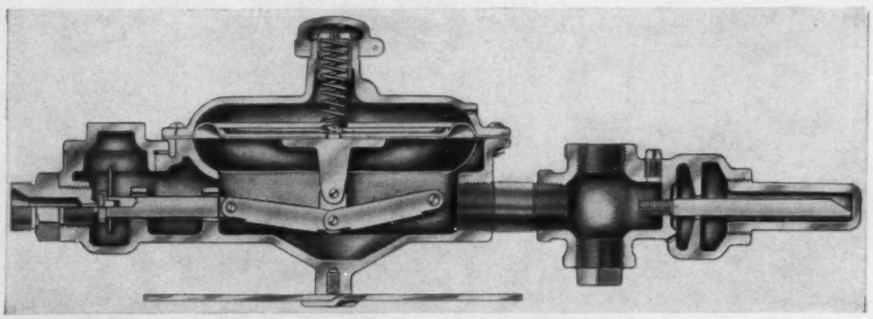
The Reynolds Liquefied Gas Regulators are recommended for installation where inlet pressure does not exceed 300 lbs., and for delivery pressure in inches W. C. or ounces of mercury. They are available either with or without intake manifold and in either a two-way, single-valve manifold or a double valve manifold.

Two features that make the Reynolds Model R-8000-B 2 Regulator unusually popular with engineers are the removable control spring which eliminates need of taking off the top cover of the regulator, and the removable valve pocket which permits changing valve seats without molesting the installation.

All materials used in the construction of the R-8000-B 2 Model 30 Reynolds Regulators . . . diaphragms, valves, valve discs, orifices, etc. . . . are especially selected to insure proper operating of the regulators on liquefied gas. They are tried, tested and backed by Reynolds 45 years of experience in building regulators to meet every gas control requirement.

For complete cooperation in selecting the proper regulator for your control requirements, write Reynolds representatives, branch offices, or the factory direct.





Above: Reynolds new bottled gas regulator with removable valve pocket.
Top Right: Exterior of regulator in vertical position.

REYNOLDS PRODUCTS

HIGH PRESSURE SERVICE HOUSE REGULATORS—Straight Lever Type, Models 0-10-20 Series. Toggle Lever Type, Model 30 Series.

LOW PRESSURE SERVICE OR APPLIANCE REGULATORS.

DISTRICT STATION REGULATORS, SINGLE OR DOUBLE VALVE—Auxiliary Bowl and Automatic Loading Device Optional.

HIGH PRESSURE LINE REGULATORS—Pilot Loaded—Pilot Controlled.

TOGGLE TYPE REGULATORS—Single Valve—Double Valve—Triple Outlet.

SEALS—Dead Weight or Mercury. Back Pressure Valves—Automatic Quick Closing Anti-Vacuum Valves—Automatic Shut Off Valves—Lever Operated Valves—Louver Operated Device—Atmospheric Regulators—Vacuum Regulators.

RECOGNIZED GAS CONTROL SINCE 1892

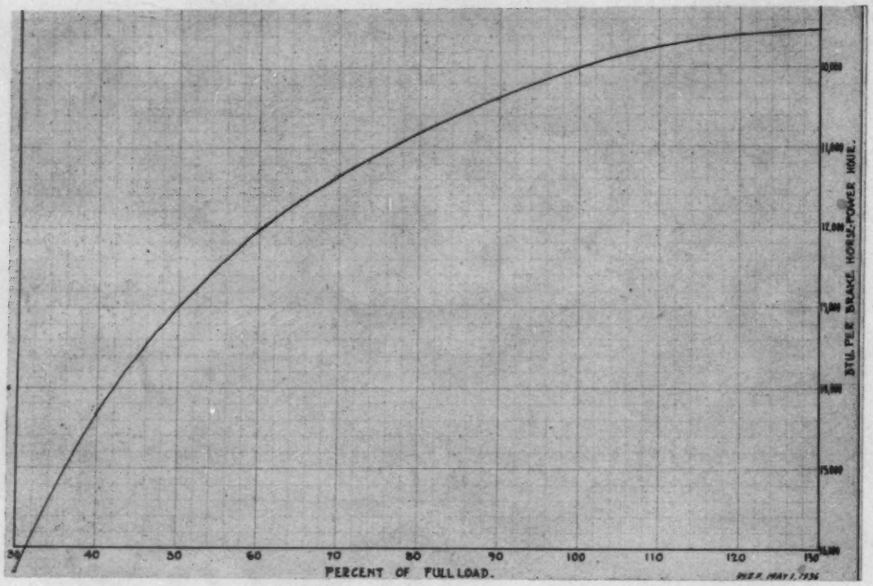


FIG. 4. Gas engine fuel consumption—B.t.u.'s per brake horsepower hour at various loads.

of transfer of energy from the shaft of the engine to the shaft of the pump is 100 per cent. Where the pumps must be driven by motor, this efficiency is decreased by losses in the generator, transformer, switchboard, motor and distribution system.

Another factor which affects the pumping picture is that the National Board of Fire Underwriters usually requires that the water-pumping system of the town be set up so that pumping can be done with either of two entirely independent sources of energy. Internal combustion engines could be operated either with propane or gasoline as fuel, so that if anything happened to the propane plant, it is certain that a sufficient supply of gasoline would be available in the town to operate the pump.

A particular advantage of having the water pump located in the central plant is the saving in equipment investment which could be made by connecting at least one pump, and possibly both, if they were installed in duplicate, to the same internal combustion engines used for generating the town's electric supply. In such an installation the engines would be equipped with double end drive, one end driving the alternators and the other end driving the pumps, through clutches and speed increasers.

Ice Manufacture and Cold Storage, Using Propane-Fired Internal Combustion Engines

A number of refrigeration applications of propane are now in commercial use. Propane is being used to refrigerate trucks handling meat and perishable goods. It is also being applied to the air conditioning of passenger busses and railway coaches, and other such applications are being developed at a rapid rate.

Going entirely by past practice, it has been less common for the manufacture of ice and furnishing of cold storage to be combined with other utilities. However, there is no reason why the citizens of a town should not enjoy the lower costs made possible by furnishing these in combination with the other utilities. Their inclusion in the combined plant effects a saving because of the free refrigeration furnished by the vaporization of propane used for gas service and engine fuel. During at least four winter months the refrigeration obtained by the vaporization of the propane would be sufficient to furnish all of the town's ice and cold storage requirements. During the other months of the year, the free refrigeration would serve to materially reduce the size of the refrigeration equipment required to take care of the maximum demand. By combining the refrigerating equipment with the other equipment operated by internal combustion engines, the

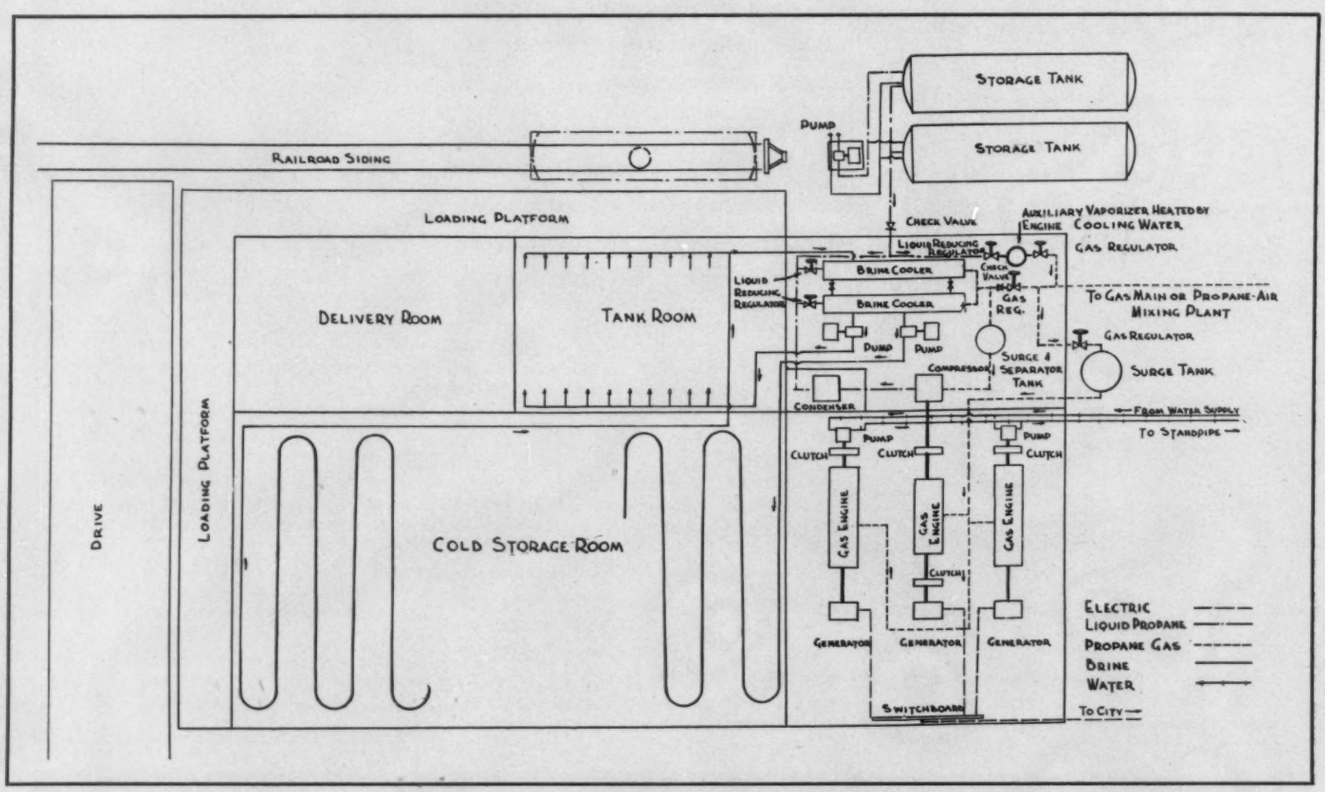
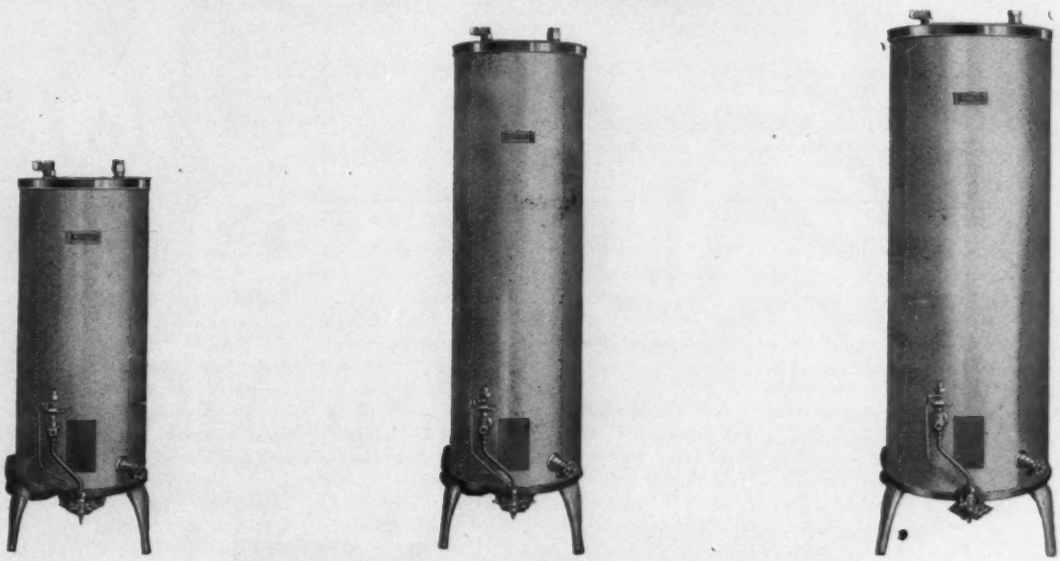


FIG. 5. Flow diagram, combined utility plant.

RUUD Gas Water Heaters

RUUD Customer Control Storage Heater

A new heating principle—plus a customer control of operating cost—combined in a full-automatic, factory-built unit.
Ruud C. C. Storage Systems have three heat speeds quickly selective by just opening or closing a gas cock.
High in efficiency—low in operating cost—RUUD C. C. is the ideal automatic storage heater for liquefied petroleum gases.

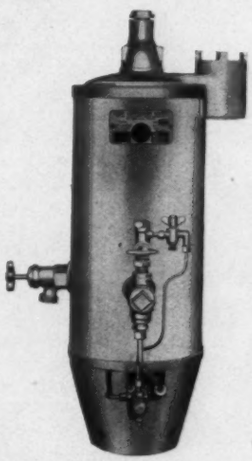


WRITE FOR COMPLETE INFORMATION

RUUD Tank Water Heaters

Ruud Pressed Steel Tank Heaters are made in three sizes with black japan finish and two sizes in chrome or porcelain enamel.

A full line of non-automatic, manually controlled water heaters. All specially equipped for liquefied petroleum gases.



RUUD Conversion Heaters

Most homes now have a tank. The RUUD Conversion Heater changes it quickly—economically—efficiently—to a full-automatic water heater. RUUD Conversion Heaters are made in two sizes. Made for the average home using from 30 to 150 gallons per day insuring low first cost and low operating cost.

RUUD MANUFACTURING COMPANY

Pittsburgh, Pa.

TABLE NO. 6. PRODUCTION COSTS OF ELECTRICITY WITH DIESEL ENGINES
(Including All Charges Except Depreciation and Interest on Investment)*

Cost of Diesel Oil in cents per Gallon Delivered to Engine	Cost of Diesel Oil in cents per kw. hr.	Other Production Cost Not Including Interest and Depreciation-cents kw.hr.	Total Production Costs not including Int. and Depreciation-cents, kw. hr.
4.0	0.43	1.32	1.75
4.5	0.49	1.32	1.81
5.0	0.54	1.32	1.86
5.5	0.59	1.32	1.96
6.0	0.65	1.32	1.97
6.5	0.70	1.32	2.02
7.0	0.76	1.32	2.08
7.5	0.81	1.32	2.13

*Average data on 35 individual plants of 495 KVA to 700 KVA installed capacity taken from 1933 Report of A.S.M.E. Sub-Committee on Oil-Engine Power Costs. Oil and Gas Power Division.

TABLE NO. 7. OPERATING COSTS*

	Diesel Engines					Gas Engines		
Station	1	2	3	4	5	1	2	3
Capacity	From 310 to 930 kw.					2450	1010	1360
Total Operating Costs/kw. hr.	.943c	1.541c	2.006c	1.703c	1.132c	.669c	1.398c	1.065c
Maintenace Costs per kw. hr.	.296	.488	.757	.695	.314	.098	.231	.158
Total	1.139	2.029	2.763	2.398	1.446	.767	1.629	1.223

*Costs for 6 years operation.

refrigeration compressors can be direct-connected through speed changers to one end of the same engine shaft that drives an alternator. Here are two important factors permitting decreased investment in ice manufacturing and cold storage equipment, the saving from which can be passed on to the citizens of the town in lowered prices for ice and cold storage.

In the past it has been customary for each meat dealer, wholesaler, or other merchant marketing perishable goods in towns of this size to have his own cold storage room, or small warehouse, or to secure his supplies in small quantities as needed, from central cold storage warehouses in larger cities, some times at a considerable distance from the town being served. This latter method means that the dealer must purchase in smaller quantities and at a higher price than if he could buy in larger quantities and store the goods himself.

In cities of the size being considered, a central cold storage plant would be constructed which could profitably be used by all of the merchants or distributors in town requiring such service. In some cases the cold storage warehouse is divided into lockers of various sizes, and any person who wants to can rent a locker of the desired size, at a rental of $0.50 to $1.00 per month.

Public frigid locker systems are now operating in Montana, Washington, and the fruit growing regions of the Northwest, and in many other localities including Thermopolis, Wyo.; Scotts Bluff, Neb.; Brunswick, Mo.; Ottumwa, Iowa; and Greeley, Johnstown, Sterling, Longmont, and Fort Collins, Colo.

Residents of the rural and outlying districts bring their products to the lockers and city residents rent the lockers to house beef purchased by the quarter at wholesale, as well as poultry and vegetables.

The operation of the ice plant compressor can be in either of two ways, as in the case of pumping; (1) by direct-driven or direct-connected internal combustion engines, operated on propane, or (2) by motor-driven compressors, the motors being operated with electricity generated by the internal combustion engines in the same plant. For the same reasons as described under water pumping—namely, the much higher efficiency obtained from the fuel—it is desirable to operate the compressors by internal combustion engines, either belt-driven or direct-connected through clutches and speed changers.

Since the peak of ice requirements is in the summer, the opposite time of the year from the usual peak of the gas and electricity requirements, engines used for generating electricity can be used for the operation of the refrigeration compressors, thus enabling them to operate at high load-factor all the year around. Since ice is a material which can be stored, the operation of the refrigeration compressor can be carried on at a fairly even rate, even during the months of highest ice consumption, and need not require any set hourly or daily peak, as is the case in the generation of electricity. For this reason, one compressor is generally sufficient for the size of town being considered here. Cold storage effect, on the other hand, cannot be stored, but in this case the amount of propane liquid which must be vaporized continuously, even during the summer months, will provide enough refrigeration to more than take care of the cold storage requirements of the town.

To prove that the assumption of responsibility for all of the municipal services described should be well within the scope of the functions of a utility company, it is only necessary to point out the present fundamental requisites for a successful utility company:—that it offer a maximum amount of service to the community at the lowest possible cost. If the attainment of these results is not definitely planned for in advance by the company management, they will be forced upon it by the tendency on the part of the towns to resort to municipal operation if the various services become too high in cost or too low in quality. By offering a combination of services at the low cost and in the efficient manner made possible by the central plant operation described, the utility company can make itself such an important part of the community life that its value will be more fully appreciated by all of those whom it serves.

■ ■

Summer Gas Air Conditioning Subject of A.G.A. Booklet

"SUMMER Air Conditioning with Gas," a 22-page pamphlet, has just been issued as Interim Bulletin No. 29 by the Commercial Section, American Gas Association. It is the first of the 1936 series of bulletins covering important phases of house heating and air conditioning by gas sponsored by the House Heating and Air Conditioning Committee. W. Andrew Scully, Consolidated Edison Co. of New York, Inc., is chairman of the subcommittee on summer air conditioning.

The booklet is divided into four sections. The first section tells briefly the history of the co-ordination of the gas industry and the field of air conditioning. Section 2 reviews the work done in air conditioning, emphasizing the accomplishments of 1935. Section 3 describes present available equipment. Equipment now in process of development by various manufacturers is not included in the bulletin. In Section 4 members of the committee preparing the booklet forecast the future of gas air conditioning and tell what it will mean to both gas utilities and appliance manufacturers.

Three charts show the refrigerating capacity of the Waukesha Ice Engine (Commercial Type), gas costs for various gas rates, and gas consumption with various heat content and variable refrigeration loads. Gas dehumidifier installations in 1935 and up to August 15, 1936, are listed.

■ ■

Ohio Fuel Gas Aids State In Preserving Wild Life

Six hundred pheasants, reared on the game preserve established by the Ohio Fuel Gas Co., at Boden, Ohio, are ready for distribution to various game preserves, according to announcement of Larry Wooddell, Ohio conservation commissioner.

The Ohio utility company, which has its headquarters at Columbus, opened a six-acre tract for wild game preservation in May, 1936. It specializes in hatching pheasants, cooperating with the state conservation department in the propagation of wild life.

■ ■

Lone Star Builds Jetties

To prevent washing of the river bank at a point where an 18-inch pipe line is supported by a trestle across the Pease River, near Vernon, Texas, Lone Star Gas Co. is building jetties along 3300 feet of the river bank. The jetties will catch driftwood and other debris and thus build up a barrier. More than 400 jetties were laid in one week.

THE SPRAGUE METER COMPANY

BRIDGEPORT, CONN.

Los Angeles, Calif., San Francisco, Calif., Davenport, Iowa, Houston, Texas

METERS AND REGULATORS for Propane, Propane-Butane and Carburetted Gases.

An innovation in the Bottled Gas Industry is that of metering liquefied gases.

The advantages of introducing a meter in a bottled gas system are:

1. Gives accurate record of gas consumed and serves as a basis for settling accounts to the entire satisfaction of the consumer.
2. Partially exhausted containers may be removed at will and "short tanks" may be delivered without injustice to the consumer.
3. Eliminates the objectional peak-delivery of tanks each month.

Although we manufacture a meter with a D-type valve we recommend our No. 1A meter with an oscillating slide valve for measuring bottled gas.

Sprague Standard Cast Iron Gas Meters are specially assembled for bottled gas service and they are also equipped with a special index reading in "Bottled Gas Units"—each unit being equivalent to ten gasified feet of liquefied petroleum gas.

The phrase, "Bottled Gas Units," was used rather than B.T.U.'s, Therms, etc., because it seemed to be more analogical with the bottled gas industry. Then again, household users are accustomed to reckoning gas at a certain price per thousand cubic feet. This association has become a psychological fact, and to try and sell bottled gas in cubic feet rather than some other unit of measure would entail a considerable amount of explaining to point out the reason for the difference in price per cubic foot of bottled gas with that of manufactured gas, especially when the average consumer has little or no conception of the B.T.U. values of the two gases.

Although we recommend a "Bottled Gas Units" index for measuring liquefied petroleum gas we are in a position to supply indexes for measuring in Cubic Feet, Pounds, Blaugas Pounds, Butane Units, or we can make up special indexes bearing special trade names such as Philgas Units, Pounds of Pyrofax, Vapyre Units, Delcogas Units, etc.

PREPAY METERS

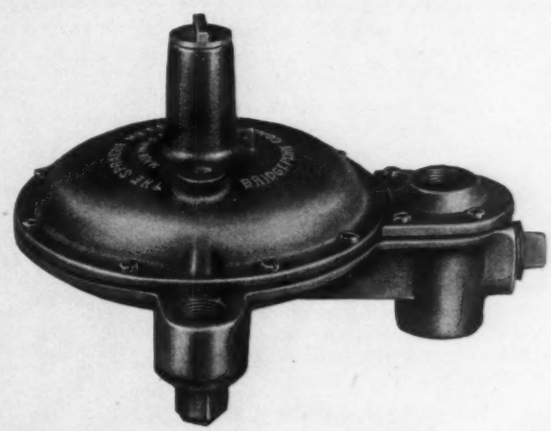
Sprague Prepay Meters can be furnished to deliver anywhere from 4.8 to 500 cubic feet of gas per coin, using a 5c, 10c or 25c coin. In ordering prepay meters kindly state the number of cubic feet you desire to have delivered per coin.

NO. 5 HIGH PRESSURE METER

We recommend our No. 5 High Pressure Meter for carburetted butane station plants.

REGULATORS

Sprague High and Medium Pressure Regulators are adaptable to either pure-propane, propane-butane mixtures or carburetted gases. They are equipped with special super-sensitive diaphragms and valve materials to withstand the action of these specific gases. Special mercury seal cups enable sealings up to 20″ H20. These regulators will handle inlet pressures from 6″ to 150 lbs. and will deliver outlet pressures from 2″ to 6 oz.



Write In for Additional Data

European, African, Asiatic Expansion of Liquefied Petroleum Gas Service

(Continued from Page 51)

which is put in operation by pushing down a lever combined with a shut-off valve. For filling the cylinders a special check valve is used.

Although difficulties were encountered in the beginning with this type of equipment, it is now reported to be operating very satisfactorily.

Butasem is marketed in about half of the French departments, but it is stated that next year it will be marketed on a national scale.

3. Butagaz is marketed by the company of the same name, formerly known as U. R. G. Cylinders and regulators are similar to those used by Primagaz.

The distribution is on a nation-wide scale.

Germany: Liquefied petroleum gas is being distributed in Germany by one company only, the I. G. Farbenindustrie Aktien Gesellschaft and their authorized dealers. Propane is used exclusively, both for domestic and industrial purposes.

The cylinders used measure approximately 9 inches in diameter and 40 inches in height, weigh empty about 60 lbs. and hold 33 lbs. of propane. These cylinders are very strongly built (seamless construction) and are fitted with valves equipped with a frangible disc.

At this writing, propane sells at Rmk 0.70 per kilog. which, at the present rate of exchange, corresponds to 12 cents per lb.

On account of the high cost of the equipment used, a rental is charged or a deposit required, which is partially reimbursed upon restitution of the equipment.

No figures have been made available concerning the amount of units in service. The potential market in Germany is rather large, as half the homes are not supplied with city or manufactured gas.

The propane gas distributed through I. G. Farbenindustrie A. G., is obtained as by-product in their synthetic plants called Leuna-Werke.

Fig. 2 illustrates the type of equipment used. It will be noted that, contrary to practice common in Europe, the cylinders are placed outside the homes rather than inside. Inside installations are allowed only under certain conditions and subject to approval by the local Fire Board.

Holland: Both the Royal Dutch Shell and the Standard Oil groups are marketing bottled gas in Holland, the former under the trade-name of Butagaz and the other under the trade-name of Primagaz. The equipment used is nearly exactly the same as in France; in fact, some of it is of French manufacture.

France and the United States supply the gas. As previously mentioned, Holland will be shortly more than self-supporting in that regard and the distribution of propane-butane throughout Dutch territory will undoubtedly take an upward swing.

Greece: No organized distribution at this time, but a number of companies are actively studying the matter. Greece is favorably located to receive the gas from abroad and the lack of gas-works throughout the country should favor the development of the bottled gas industry.

Hungary: No distribution at this time. A prominent Hungarian manufacturing company sells considerable quantities of steel cylinders and appliances for bottled gas for export.

Italy: At this writing, no liquefied petroleum gas is being distributed in Italy or its African possessions. However, several companies are studying the possibilities of entering the field and it may be safely assumed that within a short time Italy will have a complete bottled gas service both at home as well as in her African possessions.

Nordic Countries: Of the two Nordic countries (Sweden and Norway) none appears to have any organized distribution of liquefied petroleum gas.

There is little doubt but that these countries offer considerable possibilities but, due to geographical conditions, large investments would be required to organize distribution in these countries.

Poland: Official statistics are available covering the production, internal consumption and export of liquefied petroleum gas in Poland since 1928. These figures are given here below:

Year	Production (metric tons)	Internal consumption (metric tons)	Export (metric tons)
1928	8	8	—
1929	38	38	—
1930	59	45	—
1931	127	118	—
1932	350	376	—
1933	561	500	19
1934	755	667	62
1935	1188	880	108

Liquefied petroleum gas in Poland is produced principally by two companies: Malopolska and Gazolina, both in Boryslaw, the center of the Polish oil and gas industry.

The former company installed in 1930 a two-column stabilizer of American manufacture, which has been described in pages 249 and 250 of the second edition of the "Handbook, Butane-Propane Gases."

Commercial propane and an iso-butane/butane mixture are being manufactured in this plant.

The company also owns a number of tank cars specially built for shipment of liquefied petroleum gas. These tank cars are shown in Fig. 3.

Although bottled gas has been produced in Poland as far back as 1928 the distribution for domestic purposes is negligible. Lack of capital and the low purchasing power of the population are the principal reasons for this extremely slow development. On the other hand, the quantities used for industrial purposes are not inconsiderable, and the trend towards increase is unmistakable. Among the principal users are the textile industry in and around Lodz, the glass works, the metallurgical industries and the gas works. A few hospitals, dispensaries and laboratories also use the fuel to some extent.

Portugal: Only two gas works exist in this country and unquestionably there is a market for bottled gas. No distribution at this writing.

Roumania: The situation in this country is similar to that in Poland, inasmuch as the low purchasing power of the population more than counterbalances the availability of the very substantial quantities of propane and butane obtained from natural gas and gasoline.

Besides the Royal Dutch Shell and the Standard Oil interests, which produce substantial quantities of propane and butane, at least two more refineries have equipped their plants with stabilizers and fractionators. Three or four companies offer a limited service of bottled gas for domestic purposes. No official statistics are available.

Roumania will presumably be in the future an important factor in supplying liquefied petroleum gas to Central Europe and the Near East.

Soviet Russia: No information has been made available at this writing. The potential production is a very large one and incidentally in the future bottled gas will be made available in the Soviet territory.

Spain: The oil industry in Spain being monopolized, it is not surprising that the distribution of bottled gas is also supervised by the State. The Propagadora Del Combustible Liquido, S. A., at Barcelona, has the monopoly of distribution of bottled gas throughout Spain. This company is supplied by the Campsa which is the Spanish Government official petroleum agency. The liquefied petroleum gas imported is said to be partly of American and partly of French origin.

United Kingdom: One company only distributes bottled gas in the British Isles, viz.: the Calorgas Ltd., which has three distinct organizations: one for England and Wales, one for Scotland and one for the Irish Free State. The product marketed is a mixture of propane, iso-butane and butane and is supplied by the Imperial Chemicals Ltd., from their coal utilization plants.

The equipment used is similar to the one popular in France, viz.: small regulators which screw directly on to the cylinder valves.

Bottled gas does not seem to be as popular in England as it is in France, although the companies engaged report good progress. Some of them have started the use of bottled gas for industrial purposes, particularly for steel cutting.

In connection with the above, it may be mentioned that a company has been organized some time ago, for the exclusive sale of propane for cutting purposes. The results are said to be satisfactory.

A recently constructed refinery in England, which used the Duo-Sol process for the dewaxing of oil, has been importing in the past American propane for this purpose. It is now

THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Conn. ANACONDA from mine to consumer REG. U.S. PAT. OFF. Offices and Agencies in Principal Cities

Products: Anaconda Deoxidized Copper Tubes in Standard Sizes, Types K and L; Also Anaconda Solder Fittings and Cast Bronze Flared Tube Fittings

In recent years copper tubes for threadless assembly with solder, flared tube and compression-type fittings have become widely used. Copper tube installations offer the following advantages: They are rust-proof, flexible, extremely easy to install and relatively low in cost; the long lengths available reduce the number of fittings required and the labor of installation.

Anaconda Copper Tubes

Anaconda Deoxidized Copper Tubes, together with Anaconda Solder Fittings and Cast Bronze Flared Tube Fittings, are readily available from leading supply houses throughout the country. Specially deoxidized to increase strength and corrosion resistance, these precision-made tubes in sizes up to and including 1¼" are finished soft in 30, 45 and 60-foot coils; also hard or soft in 20-foot straight lengths. Sizes over 1¼" are furnished hard or soft in 20-foot straight lengths.

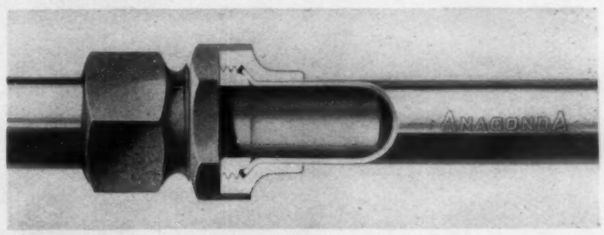
Wall Thicknesses — Anaconda Tubes are made in two weights—Types K and L, both of which meet their respective requirements as issued in U. S. Government Specification WW-T-799 and A. S. T. M. Specification B-88-33. Type K, the heavier, is recommended exclusively for underground installations, and is preferred to Type L for all other work.

Listed by Underwriters' Laboratories — Annealed (soft) Anaconda Type K Tubes in underground service sizes have been tested and listed under reexamination service by Underwriters' Laboratories for connecting gas and oil appliances.

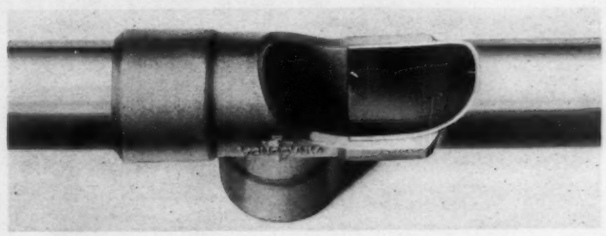
Fittings—Anaconda Cast Bronze and Wrought Copper Solder Fittings are furnished in all standard types and sizes from ⅜" to 4" inclusive. Anaconda "Flared Tube" Fittings, made of cast bronze are available in standard sizes and combinations of sizes from ⅛" to 2" inclusive.

Bottled Gas Installations

Widely used for service connections and control unit tube, Anaconda Copper Tubes may be depended upon to serve efficiently—year in and year out. Complete freedom from rust provides true economy, reduces servicing and promotes good will. Soft coils in long lengths facilitate installation, minimize waste and cut down the number of fittings required.



Anaconda Type K Copper Tube assembled with Anaconda Flared Tube Fitting



Anaconda Type L Copper Tube assembled with Anaconda Cast Bronze Solder Fitting

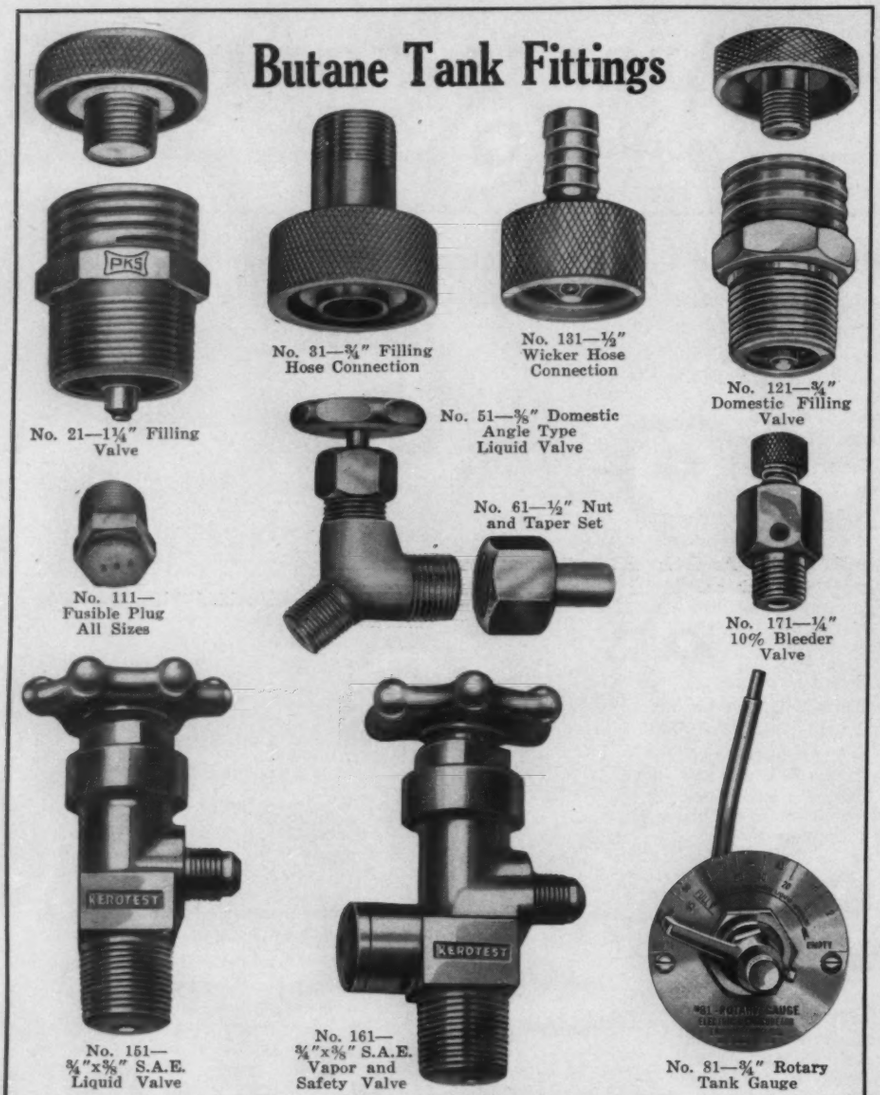
Small Mains and Services

Extensive investigation by leading utilities has revealed that the life of copper tubes in underground use varies up to and somewhat beyond ten times that of ferrous metal—depending on local conditions. Since the rate of corrosion and the thickness of tube walls combine to determine serviceable life, the heavier Type K tubes are recommended where soil is corrosive. As a result of the savings gained through greater durability, and because of their relatively low cost and obvious installation advantages, copper tubes are being used by several large gas companies for all new services and for the replacement of existing lines as they rust out. For the same reasons, copper tubes prove worthwhile for small mains and have already been used to considerable extent for this purpose.

Installing small gas main of Anaconda Type K Deoxidized Copper Tubes

Nominal Size	O. D.—In.	I. D.—In.		Wall—In.		Lbs. Per Ft.	
	Types K & L	Type K	Type L	Type K	Type L	Type K	Type L
⅛"	.250	.186	.200	.032	.025	.085	.068
¼"	.375	.311	.315	.032	.030	.134	.126
⅜"	.500	.402	.430	.049	.035	.269	.198
½"	.625	.527	.545	.049	.040	.344	.284
¾"	.875	.745	.785	.065	.045	.641	.454
1"	1.125	.995	1.025	.065	.050	.839	.653
1¼"	1.375	1.245	1.265	.065	.055	1.04	.882
1½"	1.625	1.481	1.505	.072	.060	1.36	1.14
2"	2.125	1.959	1.985	.083	.070	2.06	1.75
2½"	2.625	2.435	2.465	.095	.080	2.92	2.48
3"	3.125	2.907	2.945	.109	.090	4.00	3.33
3½"	3.625	3.385	3.425	.120	.100	5.12	4.29
4"	4.125	3.857	3.905	.134	.110	6.51	5.38
5"	5.125	4.805	4.875	.160	.125	9.67	7.61
6"	6.125	5.741	5.845	.192	.140	13.87	10.20

Butane Tank Fittings



No. 21—1¼" Filling Valve

No. 31—¾" Filling Hose Connection

No. 131—½" Wicker Hose Connection

No. 121—¾" Domestic Filling Valve

No. 51—⅜" Domestic Angle Type Liquid Valve

No. 61—½" Nut and Taper Set

No. 111— Fusible Plug All Sizes

No. 171—¼" 10% Bleeder Valve

No. 151— ¾"x⅜" S.A.E. Liquid Valve

No. 161— ¾"x⅜" S.A.E. Vapor and Safety Valve

No. 81—¾" Rotary Tank Gauge

MANUFACTURED BY

P. K. S. TOOL and MFG. CO.

Pioneers-Butane Fitting Industry

KEROTEST MANUFACTURING CO.
Pioneers-Domestic and Bottled Gas Industry

HOLZAPFEL INSTRUMENT CO.
Pioneers-Butane Regulators and Proportional Mixing Valves

DISTRIBUTED BY

Electric & Carburetor Engineering Co.

Complete Butane and Natural Gas Equipment for Trucks, Tractors, Busses and Industrial Engines

1201 SANTA FE AVE. LOS ANGELES, CALIF.

stated that the company will produce its own propane and even market the surplus of it for industrial and domestic purposes.

Yugoslavia: No information has been made available at this writing as to the status of the industry in Yugoslavia. The products could be supplied from Roumania.

Africa: In many parts of Africa, bottled gas is being distributed by subsidiaries of companies operating in the respective metropolitan countries. Thus in Northern Africa we find subsidiaries of French distributing companies in Algeria, Tunisia and Morocco. In Central Africa there is a small organization active in French Equatorial Africa, while Petrocongo, subsidiary of Petrofina, a Belgian corporation, distributes bottled gas throughout the Belgian Congo.

No activities have been reported from South Africa although it should prove a rather remunerative territory, as the country is very prosperous.

Italy is actively studying the problem of distribution of bottled gas not only within her metropolitan borders, but throughout her large African Empire as well.

There is at least one French company selling butane for domestic purposes in Egypt with equipment and gas supplied from France.

Asia: Palestine, Syria and the British Indies are the only Asiatic countries from which information regarding the bottled gas industry has been made available. Two companies are operating in Palestine, one of them relying entirely on French supplies and the other using American equipment and partially American butane. As the country is prosperous, the development of the bottled gas distribution appears satisfactory.

Two companies, subsidiaries of French corporations, are engaged in the distribution of butane for domestic purposes in Syria, which is under French protectorate. Developments appear to be rather slow.

The introduction of the bottled gas industry into British India is very recent. A company financed by local capital has been formed some time ago and first shipments already made. The gas and equipment used are of American make, the very simple heating appliances being of Belgian manufacture.

In concluding this article, the writer wishes to express his appreciation to the following companies who have supplied valuable information in regard to their activities. These companies, listed alphabetically, are as follows: Acide Carbonique Pur S. A., Brussels, Belgium; I. G. Farbenindustrie A. G., Berlin, Germany; Le Gazol S. A., Brussels, Belgium; A. E. Liotard Freres S. A., Paris, France; Malopolska, Lwow, Poland, and S. E. Modiano, Paris, France.

■ ■

New Arkansas Gas Field Looms in Nevada County

Possibilities of another large gas producing field in southern Arkansas loomed when Clyde Cox and associates drilled into the Nacatosh sand at 1170 feet, while completing its Hayne No. 1 in Nevada County. This well, near the Troy field, is located in 5-14-20, 1¾ miles north of production. It was brought under control by the operators after running wild for a couple of days. It is estimated to be making 20,000,000 cu. ft.

Butane

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FUEL SUPPLY
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EQUIPMENT

Automotive Conversions • Gas Plants • Bulk Storage Stations

AMERICAN LIQUID GAS CORPORATION

650 South Grand Avenue • Los Angeles, California

Seek Charter for Midwest Section of N. B. G. A.

PETITION for a charter for a Midwest Section of the National Bottled Gas Association was drawn up and signed at a meeting on February 9 at the Palmer House, Chicago, Ill., at which plans for a Midwest Section were completed.

Walter Verkamp, Verkamp Corp., president of the National Bottled Gas Association, acted as temporary chairman until the election of B. D. Geroy, Illinois Bottled Gas Co., as president; Otto Kohl, Bupane Gas Co., vice-president; and George Bach, Skelly Oil Co., secretary.

Two meetings a year were decided upon, one to be held in the early spring and one in the late autumn. The first regular meeting of the Midwest Section was set for April 2, 1937, at Cedar Rapids, Iowa. Otto Kohl, vice-president, was appointed host.

The organization meeting in Chicago grew out of the suggestion of B. D. Geroy and Ross Thomas, Philgas Co. Twenty-five persons attended the morning session.

■ ■

Joplin Tourist Camp Installs Modern Gas Fixtures

Forty fully gas-equipped cabins have just been completed near Joplin, Mo., for Korondo Kourts, a modern hotel type of tourist camp. Each of the modern cabins has an independent gas circulating heater vented to the flue and Pittsburgh Monarch automatic storage water heater. The office, lounge, cafe and dance hall, and the service station are also all equipped with independent gas circulating heaters.

The equipment was sold and installed by The Gas Service Co., Joplin. The owners of Korondo Kourts are contemplating the erection of 20 additional cabins. W. E. Karden, new business manager for The Gas Service Co., has long encouraged the use of closed heaters in tourist cabins, and many other camps have installed them since they were placed in Korondo Kourts.

■ ■

Fresno Butane Distributor Takes Larger Quarters

C. S. Merriman Co., Fresno, Calif., pioneer in the San Joaquin Valley in the distribution of butane and sale of butane appliances, moved recently to larger quarters, necessitated by a 100 per cent increase in business in 1936. The company now serves more than 1000 customers, and has a staff of thirteen.

Two years ago Mr. Merriman added the butane service to his household appliance business. Demand for butane has increased so rapidly that he is now dealing in butane and butane appliances only.

■ ■

Peoples Gas Light Income Doubles Over 1938

The Peoples Gas Light and Coke Co., Chicago, Ill., in 1936 had net income nearly double that of 1935 and the largest since 1932. George A. Ranney, chairman, in the annual report announced that consolidated net income of the company and its subsidiaries for the calendar year was $2,133,280. This was equal to $3.21 a share on the 664,421 shares of outstanding stock.

Gross earnings in 1936 were $39,817,015, an increase of $2,835,554 over 1935. Net operating income was $5,154,605 in 1936; and $5,116,047 in 1935.

Income from dividends in 1936 included an initial dividend of $560,000 from Natural Gas Pipe Line Co. of America.

Total revenue from sale of gas increased 7.72 per cent over 1935—from $36,181,118 to $38,975,110. The company serves about 820,000 customers.

Domestic appliances sales, under the reorganized sales department, increased over 1935.

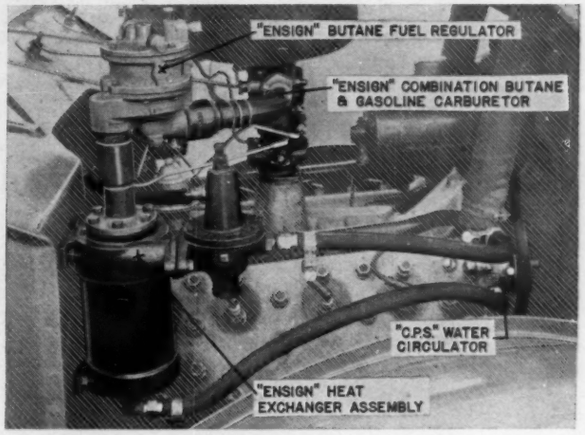
Propane Used in Experiment On Railway Refrigerating Car

Propane gas is used by the Canadian Pacific Railway to prevent freezing and to maintain proper temperatures in a refrigerating car carrying perishable goods, according to O. C. Walker, chief of perishable traffic for the company.

Equipment consists of an underslung gas heater and a propane container large enough to hold sufficient gas for the 6000-mile trip from Montreal to Vancouver and return. Inside temperatures, top and bottom, are shown on a thermometer on the outside of the car.

ENSIGN BUTANE-PROPANE EQUIPMENT

Precision-Built, Service-Proved Equipment For All Types of Butane and Propane Conversions


"ENSIGN" BUTANE FUEL REGULATOR
"ENSIGN" COMBINATION BUTANE & GASOLINE CARBURETOR
"C.P.S." WATER CIRCULATOR
"ENSIGN" HEAT EXCHANGER ASSEMBLY

Ensign Butane-Equipped Ford V-8

A pioneer manufacturer of Butane-Propane equipment, Ensign can supply you with THOROUGHLY PROVED devices for the conversion of all types of engines to these economical fuels . . . moreover equipment built with the same extra quality and fine precision of Ensign natural gas and gasoline carburetting devices.

Ensign Butane-Propane equipment embodies basic principles of design and sequence of connection which have evolved from a comprehensive knowledge of carburetion requirements in actual experience. Ensign has furnished equipment for, and assisted in the conversion of, engines in a wide variety of service in ten states, operating in a temperature range from 17 degrees below zero to 118 degrees above; and in an altitude range of 250 feet below to 6000 feet above sea level.

Ensign is prepared to furnish you with both equipment that is RIGHT and the RIGHT equipment for every conversion. Write for complete information.

Ensign Carburetor Company, Ltd.

Huntington Park, California

Chicago Branch: 2644 So. Michigan Avenue. Distributors with Stocks: A. W. Schuller, Inc., Tulsa, Okla.; The Binkley Company, Oklahoma City, Okla.; Portable Rig Company, Houston, Texas; H. G. Makelim, Oakland, Calif.; T-V Supply Company, Wichita, Kansas.

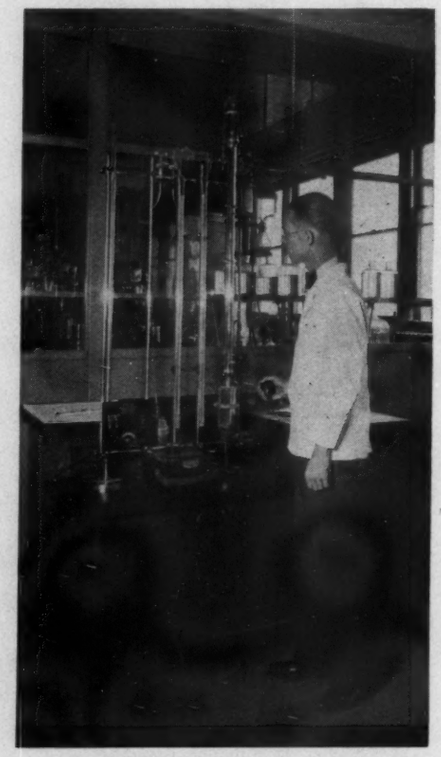
Progress in Bottled Gas Appliances

(Continued from Page 62)

American Gas Association is, in itself, a significant indication of the improvement which has been brought about in bottled gas appliance design during the past few years. It is extremely doubtful, for example, whether any bottled gas range manufactured seven or possibly even five years ago, could comply with all of the requirements which the 294 ranges indicated above must necessarily have met to be granted approval. For specific data on improvements which have been brought about in the performance of bottled gas ranges, the reader is referred to an extremely interesting and informative article by Mr. W. Z. Friend of the Philgas Department, Phillips Petroleum Co., which appeared in the September, 1936 issue of *G A S.*

Perhaps the most notable achievements in the past two years on bottled gas ranges have been increases in speed and thermal efficiencies of oven and top sections, development of burner and control equipment permitting maintenance of low oven temperatures, and improvement of top burner lighters and pilots so as to provide effective ignition. As one specific instance, throughout the past year all propane gas range top burner sections approved for use on this fuel have been required to show at least an 11 per cent increase in efficiency over that required in 1935 and many ranges have exceeded this increase. The improvement in lighter and pilot development now permits equipping ranges with automatic top burner ignition systems, an important convenience feature which was rather prohibited formerly by excessive pilot rates resulting in too costly operation. While the importance of low oven temperature maintenance has been accorded considerable prominence in the past year, and justifiably so, it should be noted that combination burners with integral simmering sections have been of nearly equal value to top burner performance, in that lower turn-downs (less heat liberation) are afforded with stable flames and without sacrifice of speed. Broiler sections of bottled gas ranges have been refined in many important respects contributing to speedier, more convenient, and more efficient performance. A notable advancement has been the application of radiant surfaces which are productive of more satisfactory broiling with less fuel consumption. In short, all sections of the gas range have been bettered economically.

While it is true that progress in bottled gas ranges has followed closely that in ranges designed for use on city gases, the inherent characteristics of propane gas have introduced special and difficult problems. Its high heating value, for example, presented unusual difficulty in obtaining satisfactory low oven temperature maintenance, economical automatic lighting systems, and suitable turn-down ratios on top burners. Its high density introduced new problems in the matter of ignition systems and safety devices. Its solvent action on materials commonly employed formerly for valve seats, diaphragms, packing, and lubricants made it necessary to search for and develop new materials of a more suitable nature. These problems, of which many were also present, but to a lesser degree with city gas ranges, have been solved in a large measure. As is the case with all other types of appliances, ranges for city gases and bottled gases are fabricated, it is believed, without exception, by the same group of manufacturers. Thus, improvements brought about in the products of these manufacturers are applied to appliances for both classes of fuels insofar as is consistent with the varying characteristics of these fuels. Consequently, advancements in appearance, convenience features, construction and safe, efficient performance of city gas ranges which have been so widely acknowledged have been paralleled in many instances by bottled gas ranges.



Apparatus for analyzing bottled gases for purity.

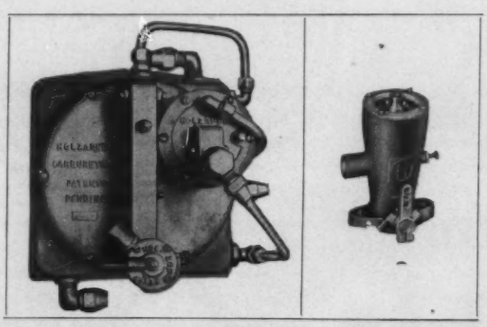
Bottled gas space heaters have become economical to operate in recent years by reason in part of increased thermal efficiencies. In fact, the approval standards for this class of equipment were recently made more rigid, a minimum thermal efficiency of 70 per cent now being required for vented heaters instead of the 65 per cent efficiency formerly specified. Moreover, the addition of circu-

(Turn to Page 102)

HOLZAPFEL
CARBURETORS
for BUTANE or NATURAL GAS
(Gasoline as Supplementary Fuel if Desired)

Maximum
Reliability
and Economy

Easy Starting
(No Choking)



Butane Unit
Note Compact Construction

Proportional
Mixer

The fact that more than half of all butane carburetors in use are HOLZAPFELS is sufficient proof of the superiority of our products.

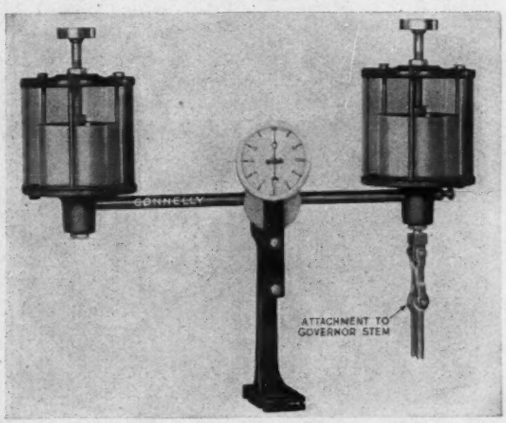
HOLZAPFEL INSTRUMENT CO.

Manufacturers of Accurate Instruments • Butane Pioneers
1625 S. ALAMEDA ST. LOS ANGELES, CALIF.

Connelly Iron Sponge Offers New Balance Loader

CONNELLY Iron Sponge and Governor Co., Chicago, Ill., announces a new device for automatically increasing the delivery pressure of station governors in step with gas volume demand.

Known as the "Smyly Balance Loader" the device consists of two mercury vessels attached to opposing ends of a bored tube lever, mounted in bearings at the fulcrum. The leverage ratio between the vessels can be adjusted by position of the standard support on the governor tank, so that 1: 1 or 2: 1 ratio can be obtained, and



extra holes provided at the base of the standard for this purpose. The tube lever is movably held in fulcrum fixture by set screw, so that this also can be adjusted to change position of the fulcrum.

The speed of the mercury transfer is controlled by needle valve below the vessel and a drain plug below the other vessel for removal of mercury, which can also be put into each vessel through an ample size hole and breather plug provided in top of each vessel. Tilting movement at stem of governor is taken care of by universal joint provided, and stroke or position on the governor stem is altered by the length of this joint which is adjustable. Both vessels tilt slightly as lever changes position above or below the horizontal, but being rigidly attached the tilt does not affect the operation.

Amount of mercury and depth in vessels to meet any local situation are provided for by diameter of displacement block and by size and number of bored holes in the block, some of which are plugged; to increase the level attained by the mercury, plugs being removed till desired level attained.

Tables and instructions are furnished for each size governor to render adjustment simple and to save time.

■ ■

Peoples Gas Light and Coke Co. Holds Court of Kitchen Relations

THE Court of Kitchen Relations is a new radio feature broadcast three times weekly by The Peoples Gas Light and Coke Co., Chicago, Ill., in which Miss Martha Holmes, home service director, is the judge before whom housewives present their cooking problems. The station announcer acts as counsel for the housewife and "Judge" Holmes offers expert advice.

Real housewives with real problems take part in the broadcasts, each participant receiving $5. They are selected from among those who fill out applications with written outlines of their cooking problems. The best problems are chosen and the women notified a week in advance of the date they are to appear. The 20 persons each week who submit the next best problems, even though the problems are not used on the radio, receive two tickets each to the broadcast and a free copy of Martha Holmes' recipe binder.

The programs are broadcast on Tuesday, Wednesday, and Thursday at 1:45 p. m. over Station WMAQ. Applications to appear in the broadcasts may be obtained at any of the branch offices of The Peoples Gas Light and Coke Co. Great interest has been shown in the novel program.

ROCKGAS

Since 1910 **For 27 Years**

Our Company was the first to sell liquid gas derived from natural gas. We began in 1910. We are experienced in the sale of Liquid Gas, which we sell under the Trade Name of Rockgas. We offer the following products:

1—ROCKGAS—PROPANE

300 lbs. pressure at 130 F—125 lbs. at 70 F. Commercially pure propane, manufactured in a most elaborate plant. 97% propane, 3% ethane. BTU per foot 2550. Cylinder loading 42% of water capacity. Odorless, but odorized by calodorant.

2—ROCKGAS

180 lbs. pressure at 130 F—70 lbs. at 70 F. A highly refined liquid gas used in thousands of domestic installations in California and Canada. One-half propane and one-half iso-butane. Contains less than 1½% of normal butane. Normal butane causes as much as 20% of ends to remain in domestic cylinders in cold weather. Years of experience indicate that normal butane should not exceed 8% in California climate. Odorized with calodorant.

3—ROCKGAS—ISO-BUTANE

125 lbs. at 130 F—40 lbs. at 70 F. Our most highly refined product. Contains 15% to 20% propane, 75% iso-butane, less than 10% normal butane. A special product and an ideal one for use in cooking in indoor type installations.

4—HEAVY BUTANE—HEATWAVE

We can also supply the usual heavy butanes which remain after the other products are made. Heavy butanes containing 50% of normal butane, 30% of iso-butane, may be supplied. These products may be used. A special heavy butane is sold by us under the trade name "Heatwave" for gasoline stoves. In certain climates which are not too cold or too hot it gives a fairly uniform pressure and starts easily. However, they are not so carefully refined, as these products are used principally for motor fuel where specifications are not material. Moreover, these products have a higher variation if used in cylinders as gas. In most climates it is necessary to use heat exchangers with these products.

CONTAINERS and REGULATORS

We stock many different size containers.
Regulators and Equipment of all kinds quickly supplied.

(1) 18½ x 56 Rockgas. Contents 225 lbs. Empty weight 165 lbs. This container is ideal for shipment of butanes where freight rates are high. We recommend it.
(2) 20 x 44 Propane. Contents 210 lbs. Empty weight 225 lbs.
(3) 12 x 42 Propane. Contents 65 lbs. Empty weight 130 lbs.
(4) 11 x 15 with automatic valve. Contents 20 lbs. Empty weight 22 lbs.
(5) 11 x 17 PK Valve, 968 Connection. Contents 20 lbs. Empty weight 22 lbs.
(6) 11 x 21 BB Valve, 970 Connection. Contents 20 lbs. Empty weight 22 lbs.

We maintain our own trucks and have had many years experience in exporting and in selling, shipping, and servicing liquefied petroleum gases.

Trailer equipment and regulators a specialty. Limited national distribution of trailer gas in 20-lb. containers.

Marine tanks and trailer tanks of many different sizes.

IMPERIAL GAS COMPANY

4212 South Broadway LOS ANGELES, CALIF.

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Eastern Office: Rockgas Products Co., P. O. Box 4126, Bellevue Branch, Pittsburgh, Pa.
European Representative: Emeric Kroch, No. 9 Rue du Moniteur, Brussels, Belgium.
Australasia Representative: N. J. Hurll, Dalton House, 115 Pitt Street, Sidney.
Central American Distributor: Carlos Muller, Panama City, R. of P.
British Columbia Representative: British Columbia Rockgas, Ltd., 1395 Granville St., Vancouver, B. C.

HAWKS BURNERS

Tested and Approved by Bottle Gas Manufacturers

Made of heavy indestructible cast iron, burner parts fit together tightly without threads. Lift apart for easy cleaning. Hooded ports prevent clogging. Arranged in clusters for industrial use.

The special construction of Hawks Burners for Bottle gas consumption provides for the proper mixtures of gas and air for efficient combustion.

Write for complete information.

HUGO MANUFACTURING CO.
49th Ave. W. and Superior St., Duluth, Minn.

KEROTESTS

the ideal valves for modern propane gas service

Incorporating the famous Kerotest Diaphragm Packless design, these strong, pressure-tested valves can be inspected or repaired while under full pressure without interrupting service from the line—thus extending their service indefinitely. They are listed as standard by the Underwriter's Laboratories and are available with or without handwheels. Try them on your next job.

KEROTEST MANUFACTURING CO.
PITTSBURGH, PA.

Safe Transportation of Bottled Gases

(Continued from Page 58)

cylinders, whether of the one-drum vapor, two-drum vapor, or two-drum liquid type. These are as follows:

1. All cylinders should be firmly mounted to prevent settling and possible breakage of connections. Flexible connections may be used to also guard against this effect.

2. Valve equipment and assembly should be protected against the weather and against tampering by a complete or partial housing, properly ventilated, which can be locked.

3. Changing or charging of cylinders is preferably done by daylight, away from open flames, with no artificial light other than vapor-proof lights within ten feet of the cylinders. All electrical apparatus which may cause sparking should be kept away from the vicinity.

4. All low pressure lines from the cylinders to the appliance must have a low pressure relief device which if installed inside buildings should be vented outside with the outlet at least 5 feet from any building opening.

5. Diaphragm type valves instead of the packed type should preferably be used on all high pressure lines to eliminate possible leakage.

6. All piping used should be approved piping for the pressures involved, and should be tested prior to use. Raw linseed oil or soap bubbles applied to joints are effective in determining leaks. Open flames should never be used to determine leaks on gas filled lines.

7. Caution should be exercised in the handling of cylinders, in that they should never be subjected to severe shock by dropping or mishandling.

The same general precautions as for above-ground tanks apply to underground tanks. However, the maintenance of underground tanks is more difficult due to lack of visual and periodic inspection, and greater care must be taken in the original installation. To prevent corrosion and electrolysis, all underground tanks should have a proper coating of protective material. This coating should be applied to all parts of the tank and care should be taken to see that it is not scraped off in moving or lowering in the excavation. Wrapping the tank in burlap after coating is effective for this protection. If tanks are installed where there is danger of flotation from ground or high water, they must be secured to a foundation.

Manholes about the tank equipment should be provided with a suitable cover and lock and should have a free vent to the outside atmosphere under worst conditions of snow, sleet and ice formation.

All liquid and gas lines from the tank, except safety valves, should be equipped with excess flow valves, to minimize danger in case of line breakage.

Truck and truck equipment should be taken out of service immediately if repairs are required. The use of diaphragm type valves, excess flow valves on all tank truck lines, proper relief valves on the truck tank and full protection against road hazards are of utmost importance.

Drivers must be educated to possible hazards, and rules for conduct set down which, if knowingly violated, should lead to immediate suspension or dismissal. Of primary importance is that cylinders or tanks should never be filled beyond the maximum filling weight or height specified.

The driver should see that the vicinity of loading or filling operations is kept free of hazards such as open lights, fires, sparks or other things which would lead to ignition of any escaping gases. Static or ground chains should be kept in good operating condition.

Venting of gases for testing, hose disconnecting or similar work should be done as infrequently as possible, but when necessary, in intermittent small amounts and never in the presence of sources of ignition. Constant vigilance with respect to possible hazards during unloading or loading operations is one of the duties required of each driver.

Tank car shipments of fuel, to a storage tank on the premises being served, are made to bulk users. Tank cars for liquefied petroleum gas are of special design and are constructed in accordance with I.C.C. specifications. Cars are insulated with 4 inches of cork and an outside metal shell to minimize temperature change during transportation.

All connections for unloading tank cars are through the tank car dome, since bottom openings are not provided. The filling and discharge lines of all liquefied gas tank cars are required by I.C.C. to be equipped with automatic excess flow valves, to shut off the flow in the event of a break in unloading connections. Suitable high pressure hoses are usually used for connection to pump or unloading lines, which provide a weak link in case the car is accidently moved. The following suggestions and procedure are outlined for tank car unloadings:

1. After car is spotted on the siding, it should be suitably braked and blocked to prevent movement.

2. "Stop — Tank Car Connected" signs should be immediately placed at switching ends of the siding.

3. Outage and temperature of tank car contents should be determined by means of slip tube gauge and thermometer well in tank car dome. Any leaks noticed should be tagged or reported.

4. Hose connection should be made between the liquid valves on the tank car and liquid inlet to pump. Likewise, hose connection should be made between vapor line on tank car and vapor line from storage tank. Hose connections should be equipped with a small hand valve for venting contents of connections after unloading, to promote safety in the disconnecting work and to avoid the sudden escape of fuel. Such venting should be done in small amounts intermittently and in the absence of any flames, or switching engine.

5. Car, rails and unloading piping should be grounded according to railroad or standard specifications to dissipate static electricity.

6. A suitable check valve should be installed on the liquid line at the pump inlet to prevent back flow of liquid in case of break in connection. The vapor line should also contain a similar valve, usually at the storage tank.

7. A sight flow glass is sometimes installed on the liquid line at the pump inlet to aid in determining liquid flow or vapor lock.

8. All motors and lights used at pump location should be suitable for hazardous locations as prescribed by the National Electric code.

9. After complete connection of unloading equipment, care should be taken to see that the liquid valve or valves (a y-liquid connection is sometimes used) are opened slowly to prevent the excess flow valves in the tank car dome from shutting off. In case an excess flow valve operates, it is necessary to close the valve above it until pressure is equalized through a small orifice provided in the excess flow valve, at which time the valve will drop into the open position.

10. Pumps should always be located below the lowest liquid level of the tank car for best unloading conditions.

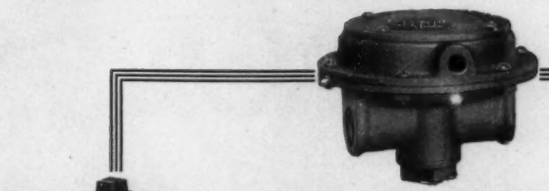
11. Some tank cars are equipped with steam coils between the insulation and the bottom of the tank car shell. The purpose of these coils is to be able to heat the car contents in extremely cold weather, in order to create vapor pressure to force the liquid up through the eduction lines. Care should be exercised to see that the car contents are not heated to a point where the resulting vapor pressure would release through the safety valves.

12. The pressure differential method of unloading is generally used on butane. If the natural vapor pressure in the tank car is above that in the storage, this natural differential pressure will unload the car. If the car cannot be entirely unloaded by natural pressure, air or gas pressure placed on the car will supply needed differential or the remaining liquid may be pumped out.

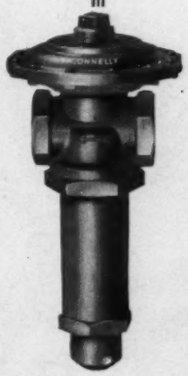
It is important that all operators engaged in the handling of liquefied petroleum gases report leaks or defects in equipment immediately. Repairs should be made as soon as possible. Proper unloading distances from hazards should always be maintained.

In the event of line breakage or safety valve opening in the presence of fire, the discharging gas should be immediately ignited at the point of release to prevent gases traveling to another point and there igniting, with resulting explosion and fire. If a tank is exposed to fire, a water stream directed on its surface will aid in keeping it cooled, thus minimizing an increase in vapor pressure and avoiding eventual safety valve opening.

Since it is essential that adequate materials, safe procedure in handling and skilled personnel be used in handling liquefied petroleum gases, it is necessary to exert constant vigilance along these lines to insure trouble-free operation. The fine record of the industry thus far should serve to indicate the value of complete co-operation between manufacturers and marketers and regulatory and insurance bodies, to assure consistent maximum safety in handling. Let us continually promote the idea that every marketer always utilize accepted safety rules, practices, and procedures so that the industry may continue to show a record of which we can be proud.

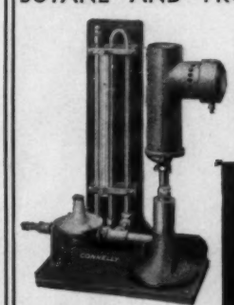


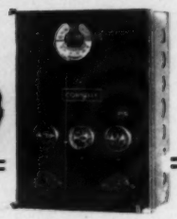
Connelly Appliance Regulator
The trend is towards regulation on all appliances and ranges. Specify Connelly, they are rugged and sensitive and satisfy the most severe performance tests. Full range of sizes ¼" to 4".



Connelly Pressure Relief Valve
For line pressures up to 125 lbs. Adaptable for use on high pressure storage tanks in compressor by-pass or any duty where an accurate "Safety Relief" is required.

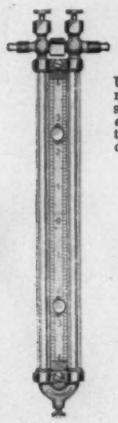
BUTANE AND PROPANE PLANT OPERATORS are using Connelly Caloroptics as the most practical form of direct reading BTU indicators. Simple, accurate and convenient. Remote indication may be furnished with photo electric indicator dial.





Distant Signal System and Alarm Units for use with BTU Indicator.

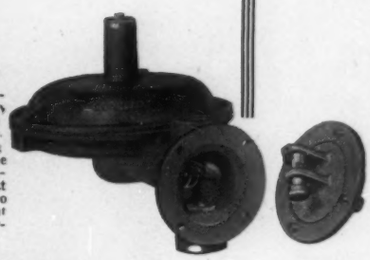
Connelly District Regulator—Style LCD
For line pressures of 100 lbs. or less to inches. An exceptionally flexible control by improved adjustable linkage connecting diaphragm and valve stem. Large sideplate renders valves and seats easily accessible. Entirely self-contained and operates perfectly under water.



Connelly U-Gauges (Unbreakable)
Universal U-Gauges made of glass substitute tube, threaded into metal fittings. Accurate and durable.

Connelly Back Pressure Valve
Prevents reverse flow in gas lines. Insures safety on industrial burners using boosted air pressure. Light weight check disc to provide low differential. Readily accessible.

Connelly Style G. V. Service Regulator
"The outstanding design of the day." Only two moving parts—single unit double guided valve insures perfect seating. Renewable streamline soft seat gives greater capacity. Valve and seat very accessible. Two types available, weight and spring loaded, mercury or "no seal."



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CONNELLY
IRON SPONGE & GOVERNOR CO.
CHICAGO, ILL. ELIZABETH, N. J.

HYDRO-GAS SYSTEMS

provide comfort and convenience, with safety and economy, beyond the reach of the natural gas lines.

HYDRO GAS
Registered

Hydro-Gas Co.
SAN ANTONIO, TEXAS

COOPERATIVE LOAD BUILDING

P. C. G. A.

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(San Diego Cons. G. & E. Co.)

COMMITTEE
DOUGLAS BUCKLER
Southern California Gas Company
CLIFFORD JOHNSTONE
Managing Director
Pacific Coast Gas Association

All gas men please note

☆ Even Father (Jed Prouty) catches the fashion spirit demanding a "gay-taste"; while Mother (Spring Byington), inspired by her new gas range, is emulatingly sure of his verdict. See the JONES FAMILY, Twentieth Century-Fox Studios, in "OFF TO THE RACES."

☆ It's fun... to plan a party

WITH A MODERN *Gas* RANGE

● What shall you serve your guests? A soufflé with melt-in-the-mouth biscuits? Or seafood patties? A filled meringue dessert? Whatever your choice, plan gaily, confidently, assured of pride and compliments. Guided by tested recipes, aided by a modern gas range, *you cannot fail.* ☆ Exact, timed temperature is the secret of baking success. Leave it to your oven heat control and new, low-temperature gas burner. Let your clock control do the *remembering*, even while you're resting or away. ☆ Completely automatic oven cookery is but one of many reasons why millions of women *insist* on a GAS range; why thousands, after trying other fuels, are *returning* to GAS. Cook with gas for speed, sure results and all-around low cost. See the new models. Your Gas Company or Appliance Dealer cordially invites you to call.

Gas THE MODERN FUEL

COOKING • HEATING • WATER HEATING • REFRIGERATION

CLASS OF SERVICE DESIRED

DOMESTIC	FOREIGN
TELEGRAM	FULL RATE (URGENT)
DAY LETTER	DEFERRED (DAY)
NIGHT MESSAGE	DEFERRED (NIGHT)
NIGHT LETTER	LETTER
GOVERNMENT	GOVERNMENT

Postal Telegraph
THE INTERNATIONAL SYSTEM
Commercial Cables

Send the following message, subject to the terms on back hereof, which are hereby agreed to

TO GAS APPLIANCE MANUFACTURERS
AND DEALERS
EVERYWHERE IN THE WEST
P. C. G. A. COOPERATIVE ADVERTISING IS WORKING FOR YOU IN TWENTY-ONE PACIFIC COAST MAGAZINES STOP ENTIRE COST PAID BY PARTICIPATING GAS COMPANIES STOP THIS FULL PAGE DOMESTIC AD FOR MARCH FEATURES GAS COOKING STOP PHOTOGRAPH POSED BY JED PROUTY AND SPRING BYINGTON OF THE MOVIES
COOPERATIVE ADVERTISING COMMITTEE

BULLETIN

See February issue *Western Machinery & Steel World* for feature article on "Gas Furnaces and Controls" prepared by your Cooperative News Service.

Outline Program for March Meeting of P. C. G. A. Technical Section

THE Technical Section of the Pacific Coast Gas Association will hold its annual spring conference in Los Angeles, Calif., March 18 and 19 in the Los Angeles Gas & Electric Corp. building.

The Sales and Advertising Section of the P. C. G. A. has set April 1 and 2 as the dates for its annual spring sales conference. Under Chairman B. W. Reynolds, the program is now being completed. Tentative plans call for round table meetings the first day. General sessions will be held on the second day, with the Commercial and Industrial committee, Advertising committee, and Domestic Sales committee reporting in the afternoon session.

Complete program for the Technical Section conference follows:

TECHNICAL SECTION

Otto Goldkamp, General Chairman
San Diego Consolidated Gas and Electric Co.

THURSDAY, MARCH 18
9:30 A. M. in Auditorium
Transmission Committee—Round Table Meeting

Gas Measurement Subcommittee: B. G. Williams, Southern California Gas Co., Chairman.

Methods of Applying Superexpansibility Factors—Chairman B. G. Williams.

Three discussion subjects.

Pipe Protection Subcommittee: H. G. Laub, Southern California Gas Co., Chairman.

Soil Corrosion Observations—C. P. de Jonge, San Diego Consolidated Gas & Electric Co.

Introduction and Elimination of High Resistance Pipe Couplings for the Mitigation of Electrolysis—W. M. Schneider, Pacific Gas & Electric Co.

Two discussion subjects.

Joint Meeting of Compressor Plants and Pipe Lines Subcommittee: H. J. Smith, Pacific Gas & Electric Co., Chairman, Compressor Plants Subcommittee. F. E. Wilson, Pacific Gas & Electric Co., Chairman, Pipe Lines Subcommittee.

Overspeed Control of Gas Engines—E. V. Stone, Stone Safety Instrument Co.

Four discussion subjects of Compressor Committee.

Two discussion subjects of Pipeline Committee.

12:15 P. M.—Luncheon

Norman Hoff, Los Angeles Gas & Electric Corp., Luncheon Chairman.

Recent Research on Gas Ranges—F. O. Suffron, Supervisor, Los Angeles Laboratory, American Gas Association.

2:00 P. M. in Auditorium
Transmission Committee—General Session

The Gas Control and Some of Its Functions—R. T. Peterson, Pacific Gas & Electric Co.

Rotary Compressors and Reciprocating Compressors—H. W. Walters, Allis-Chalmers Manufacturing Co.

Pipe Treating Yard of Southern California Gas Co.—J. B. Reddick, Southern California Gas Co.

3:30 P. M. in Auditorium
Utilization Committee—General Session

Progress Report—Guy Corfield, Los Angeles Gas & Electric Corp., Chairman.

Testing and Appraising Large Volume Water Heater Installations—J. L. Oberseider, Los Angeles Gas & Electric Corp.

Effect of Fluctuating Pressure on Domestic Appliance Performance—C. W. Stewart and C. E. White, San Diego Consolidated Gas & Electric Co.

Gas Lighting:

Progress Report: C. A. Thorp, Los Angeles Gas & Electric Corp., Chairman.

Investigation of Humphrey Opalite Wall Bracket Gas Lights—R. I. Snyder, Los Angeles Gas & Electric Corp., Chairman.

FRIDAY, MARCH 19
9:30 A. M. in Auditorium
Utilization Committee—General Session

Architects and Builders Service Subcommittee:

Progress report—Frank Moon, Los Angeles Gas & Electric Corp., Chairman.

Employee Training for Customer Utilization Service Subcommittee:

Progress report—J. E. C. Currens, Pacific Gas & Electric Co., Chairman.

Central Station and Remote District Job Training—Lee Holtz, So. Calif. Gas Co.

Results from Training Gas Service Employees, and the Basis for Future Selective Hiring—C. A. Renz and Oscar Cook, Los Angeles Gas & Electric Corp.

Gas Appliance Testing Subcommittee:

Progress report—R. I. Snyder, Los Angeles Gas & Electric Corp., Chairman.

Gas Company Appliance Testing from the Service Viewpoint—H. W. Geyer, Southern Counties Gas Co.

10:30 A. M. in Auditorium
Utilization Committee—Round Table Meetings

Gas Lighting Subcommittee: C. A. Thorp, Los Angeles Gas & Electric Corp., Chairman.

Employee Training for Customer Service Subcommittee: J. E. C. Currens, Pacific Gas and Electric Co., Chairman.

Personnel Practices for Hiring in Gas Departments—A. J. Noia, Pacific Gas & Electric Co.

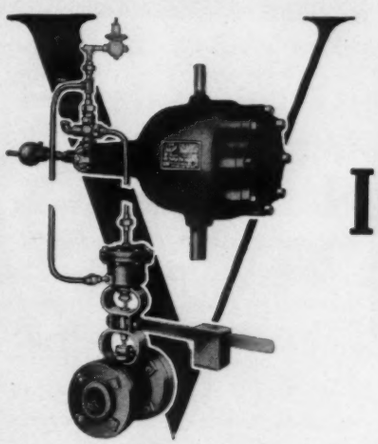
Servicemen's Training on Gas Boiler Control—C. P. Perkins and Charles Consterdine, Pacific Gas & Electric Co.

Gas Appliance Testing Subcommittee: R. I. Snyder, Los Angeles Gas & Electric Corp., Chairman.

Architects and Builders Data Book Subcommittee: F. L. Moon, Los Angeles Gas & Electric Corp., Chairman.

12:15 P. M.—Buffet Luncheon

Norman Hoff, Los Angeles Gas & Electric Corp., Chairman.



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VIGILANT
Liquid Level Regulator
with
V-Port Valve

Chaplin-Fulton pressure-control equipment has been in successful use for fifty years. Write for complete catalog.

Fluctuating demands, under light loads or heavy, cause no inconvenience where the Vigilant Liquid Level Regulator with V-Port Valve is employed. When the regulator is wide open, it has a capacity equal to that of the pipe. When flow is down to a minimum, the valve throttles automatically to keep the liquid at the level desired, without variation.

THE CHAPLIN-FULTON MFG. COMPANY
28-40 Penn Avenue Pittsburgh, Pa.

1:30 P. M. in Auditorium
Distribution Committee—Round Table Meetings

Measurement and Regulation Subcommittee: H. S. Harris, Los Angeles Gas & Electric Corp., Chairman.

Special Discussion Subjects:

Temperature and Humidity Control of Prover Rooms—C. W. Capwell, San Diego Consolidated Gas & Electric Co.

Design of Remote Control Pressure Station—W. A. La Violette, Pacific Gas & Electric Co.

Materials for Valve Covers and Seats in Positive Displacement Meters—F. H. Winslow, Southern Counties Gas Co.

Comparison of Pilot Testing versus Four-Pointing—Harry Faul, Southern Counties Gas Co.

General Discussion Subjects Included are:

Do We Buy Gas Meters on Price?

Proposed Change in the Basis of Reporting D. R. Meters.

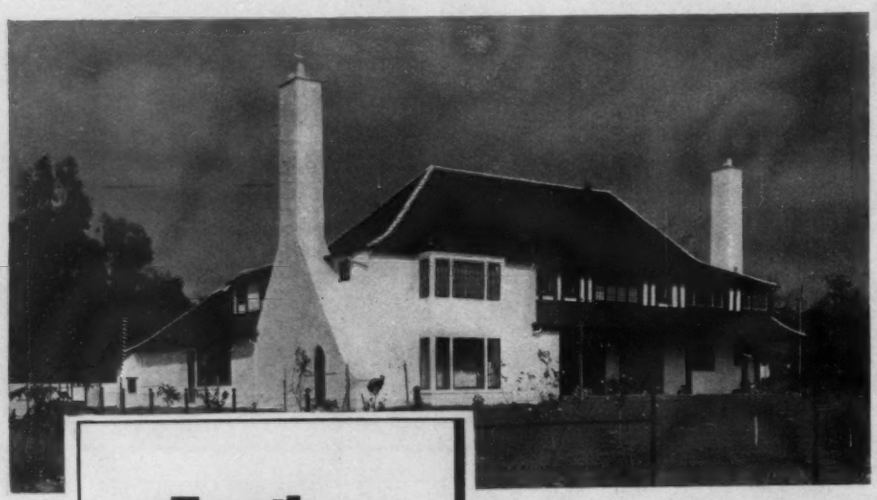
Necessity for Improvement in Gas Meters.

Unaccounted-for Gas Subcommittee: F. A. Hough, Southern Counties Gas Co., Chairman.

3:30 P. M. in Auditorium
Distribution Committee—General Session

Distribution Problems Created by Winter Loads—Discussion led by Frank Pape, Pacific Gas & Electric Co., Distribution Committee Chairman.

Report of Pressure Piping Code Subcommittee—D. H. Perkins, San Diego Consolidated Gas & Electric Co., Chairman.



Residence of Mr. Morris Shuwarger, Beverly Glen Boulevard, Los Angeles. Paul Williams, Architect.

Another
Pacific Heated
Home

PAUL WILLIAMS, prominent Southern California architect, designed this beautiful home in Beverly Glen, Los Angeles. The massive construction, the spacious setting are in the best tradition of English country life. More typical of American comfort standards, however, is the owner's choice of Pacific Heating. The very newest type of Pacific Forced-Air system was installed, giving him complete winter air conditioning and summer ventilating, automatically controlled by thermostat.

This newest and finest method of residence heating is building gas consumption all over the country even against the stiffest competition. *Write for Catalog G-3.*

PACIFIC GAS RADIATOR COMPANY

1740 West Washington Blvd., Los Angeles, Calif.

Col. W. F. Rockwell Heads Board of Spring Company

ANNOUNCEMENT has been made of the election of Colonel Williard F. Rockwell, president of the Pittsburgh Equitable Meter Co., Pittsburgh, Pa., to the chairmanship of the board of directors of the Standard Steel Spring Co., Coraopolis, Pa., manufacturer of automobile springs, with other plants at Racine, Wis.; Gary, Ind., and Allegan, Mich. His activities in the automobile industry have extended over a long period of years, and at present he also holds the presidency of the Timken-Detroit Axle Co. and the Wisconsin Axle Co.

W. F. ROCKWELL

In addition to being president of the Pittsburgh Equitable Meter Co. and its subsidiary, the Merco Nordstrom Valve Co., Colonel Rockwell holds the presidency and directorships in numerous other companies furnishing equipment to the oil and gas industries.

■ ■

A.G.A. Figures Show Industry Gains During 1936

During the first 10 months of 1936 gas industry revenues and sales showed a substantial increase over 1935, according to figures furnished by Paul Ryan, chief statistician of the American Gas Association. Natural gas sales showed an increase of 18.2 per cent over the corresponding period of last year, and during the period manufactured gas sales mounted 5.9 per cent.

Manufactured gas revenues reached $314,025,000 for a gain of 1.3, while natural gas revenue was up 11.1 per cent for a total return of $319,011,100.

November, 1936, was a better month for the gas industry than November, 1935. Total revenues of manufactured and natural gas utilities increased 6.9 per cent for the month. Natural gas utilities reported revenues 10.2 per cent greater than in 1935.

Natural gas utility sales increased 13.5 per cent; manufactured gas sales, 10.8 per cent. Sales of natural gas for domestic purposes were up nearly 9 per cent, but manufactured gas sales for domestic use fell off nearly 3 per cent.

■ ■

P.C.G.A. to Study Customer Accounting Practices

BUSINESS department practices that may be unnecessary or distasteful to the customer will be studied this year by the Customers Accounting Committee, Accounting Section of the Pacific Coast Gas Association. H. E. Davison, Southern California Gas Co., is chairman of the committee.

The committee will also study the relative merits of centralized vs. decentralized customers accounting, and the simplification of office procedure for increasing efficiency and cutting costs.

PREVIEW

of P. G and E COOPERATION with the GAS APPLIANCE SOCIETY'S

Spring

GAS RANGE CAMPAIGN

MARCH 1937

★ Newspaper advertisements
★ Window and lobby displays
★ 24-sheet poster-boards
★ Half million billstickers
★ NEW MANPOWER!

Five new men to assist dealers in their sales planning. Five new women to assist in planning demonstrations of modern gas cookery.

Watch for official Society announcement
and EXPECT A *GREAT* CAMPAIGN!

P·G·and E·

PACIFIC GAS AND ELECTRIC COMPANY
OWNED · OPERATED · MANAGED BY CALIFORNIANS

WG203-337

Analyzing Town Plant Projects

(Continued from Page 57)

type of installation is generally a single gas engine or motor driven compressor unit with sufficient high pressure gas storage in unit form to permit a minimum initial investment. Gas storage is then added as the load increases, on the basis of maintaining a 30-hour supply. The plant is operated once daily but gas storage capacity may be reduced at the expense of more frequent operation of the plant. In the case of single unit plants having only one source of power, care must be constantly exercised to keep on hand a reasonable supply of repair parts and to keep the equipment in good operating condition.

This type of plant is suitable for towns ranging from 2500 to 3500 in population. The reason for the upper limit is that in larger towns it is anticipated that ultimately semi-automatic or completely automatic plants will require less investment than the batch plant with suitable gas storage facilities. Installation costs for this type of operation range from $60.00 to $65.00 per consumer exclusive of service lines depending on the distribution system which in all instances is quite a variable feature.

Such plants offer the minimum in initial investment and in operating costs and render satisfactory service. One man can readily handle the normal operation of the plant and the other usual duties of managing the property. Or one plant operator can handle the gas making at several plants, by making regular daily rounds of the properties.

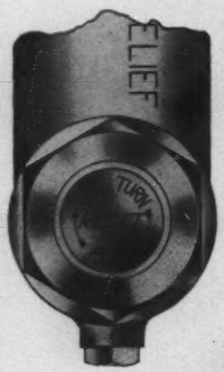
Semi-Automatic Type Plants: This type of plant consists generally of a dual motor driven compressor type plant of intermittent operation. Starting and stopping of the gas forming equipment is automatic but no automatic control is exercised over the quality of the gas manufactured. Such plants should be checked over daily and equipped with a reserve or emergency gas holder. There might also be included in this classification the continuous operating type of plant, which generally employs a blower or centrifugal type compressor discharging at from 2 to 5 lbs. pressure.

This general type of plant with its many variations to suit conditions is generally most suitable for towns ranging from 2500 to 4500 population. Automatic control over the quality of gas manufactured may also be provided. Costs on such installations may be as low as $60.00 to $70.00 per consumer, exclusive of services.

Fully Automatic Type Plants: Plants of this type are quite numerous and vary considerably in costs. In general, it is the most expensive type plant and is economically suitable only where there is sufficient gas load to warrant the expenditure or where a continuous record of the heating value of the gas supplied the town may be required. Generally it is not suitable for the average town of less than 4500 population. Some types of plants are quite efficient from a manufacturing cost viewpoint and installations have been made where the cost of the complete installation was approximately $65.00 to $70.00 per consumer, exclusive of services.

The primary factor reducing the cost per consumer in the automatic type plant is the reduction in the average length of main per consumer in the better class towns. The cost per consumer data for the butane air gas plants does not include services but includes the service connection on the mains.

Butane-Air Distribution Systems: Inasmuch as the distribution system in this type of installation represents from 70 to 85 per cent of the initial investment and as there is a greater risk involved for the load supplied than in kindred gas services, it is advisable to take advantage of any savings to be effected in the design and installation of the system. Gas loads should be accurately determined in an effort to reduce pipe line sizes to a reasonable minimum. Generally it is advisable to divide the town into districts according to the anticipated loads. Usually there are three of four districts to the average town, and the more densely populated, better district is perhaps best



Turn the knob...

and this temperature relief valve is ready to operate again without replacing any parts.

It prevents over-heating by shutting off the gas supply before the danger point is reached.

Gas men and water heater manufacturers are invited to write for particulars.

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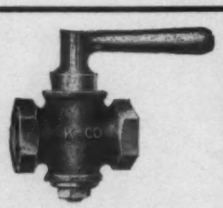
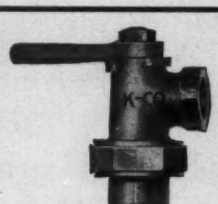


G-207—Solid Lever Standard Gas Stop

"by Kitson"
. . . The Surest Guarantee of Quality for Forty Years!



G-250—Angle Pa tern Stop with Coupling

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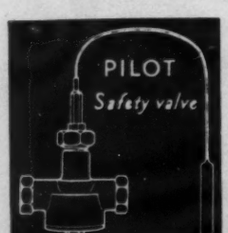
KITSON COMPANY
2409-15 Westmoreland St. Philadelphia, Pa.
Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters
Quality Brass Goods for Gas, Water and All Plumbing Uses
ESTABLISHED 1897

K-CO TRADE MARK

BUILD YOUR HOUSEHEATING LOAD WITH KLIXON CONTROLS

These two advanced Klixon devices give exact automatic temperature control and assure positive pilot protection for your gas-fired space heaters . . . provide sales features that make it easy to sell gas heating.

Write today for descriptive bulletins.



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Unit of Metals & Controls Corporation
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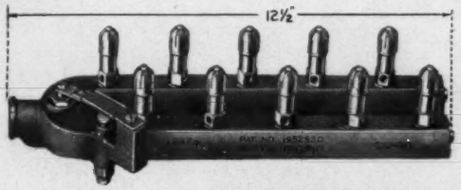
BARBER BURNERS

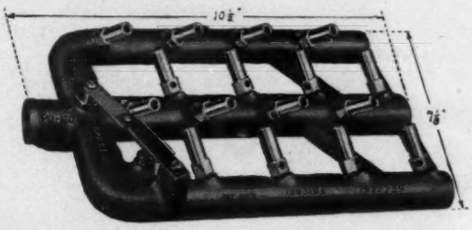
Are an Index to the Quality of Any

GAS Appliance!

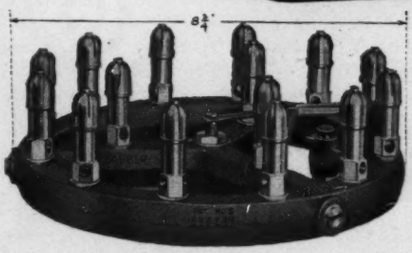
"IS this Appliance equipped with a Barber Burner?" How often have you heard that question asked about a Gas Appliance! Alert Appliance Manufacturers, sensing this trend, know that BARBER Burners smooth the path of sales resistance. They know that Gas Companies, Dealers, and the public alike have a justified confidence in anything that BARBER makes. BARBER has basic principles which **cannot be copied.** Avail yourself of the complete and improved line of BARBER Burner Units. Write for No. 37 Catalog and revised price list.



No. C. U-90
Barber Burner
with Safety Pilot

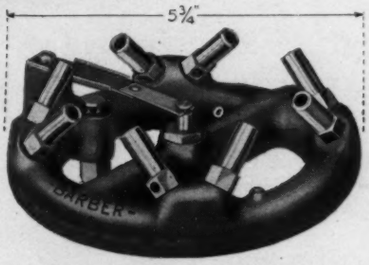


No. P. U-160
Burner



No. C. F-150 Burner

No. S. P-15 Burner



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BARBER *Automatic* **JET GAS BURNERS**

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Steam and Hot Water Boilers
and Numerous Other Heating Appliances

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the permanent Chimney Liner

Combat the destructive corrosive action of acid bearing condensate formed in the products of combustion. Install in the chimney a FLUE LINER which is impervious to these acids. Such a liner is found in VITROLINER—The Permanent Chimney Liner.

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VITROLINER—The Permanent Chimney Liner—is made of heavy gauge enameling stock iron and is coated inside and out with a special acid resisting vitreous enamel. The new Bell & Spigot type joint, now standard on all Vitroliner, insures a perfect and uniform fit of all parts. The various shapes and sizes in which Vitroliner is manufactured make it remarkably easy to line any type chimney whether old or new.

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VITROLINER—The Permanent Chimney Liner—has been used by a number of leading Gas Utility Companies for the past six years with excellent results. An inspection of the oldest installations showed the liner to be in perfect condition. This convincing evidence is ample proof that the problem of condensation can be successfully handled with VITROLINER—The Permanent Chimney Liner.

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Complete information and prices on our entire line of condensation equipment will be sent on request.

CONDENSATION ENGINEERING CORPORATION
TELEPHONE MONROE 1031
335 South Western Avenue, Chicago

served by a low pressure type distribution system. The poorer districts are generally supplied by high pressure type mains designed for about three pounds operating pressure. This pressure is about the lowest advisable pressure and can, of course, be increased in compressor type plants if required by an increased load. While a low pressure type system is perhaps to be preferred, this type of installation will not generally warrant a complete low pressure system, but in the better districts a low pressure system can be installed at reasonable cost and offers the advantage of low operating cost and of being capable of ready conversion into a high pressure type system should this necessity ever arise. However, where conversion of the property to natural gas service is contemplated, distribution system costs are naturally increased, by the need for larger lines, particularly in the poorer and remote districts, to handle house heating loads, etc.

Operating Costs: From this viewpoint the propane plant is much superior to the butane air plant. A propane plant normally demands infrequent inspection, as there are no compressors, etc., required. Labor is, therefore, a negligible item, as also are repair parts and maintenance.

Butane air plant operating costs while higher than that of propane plants are much lower than those for the usual manufactured gas plants for the same gas delivery. In all types of plants there is generally required from one-half to two hours per day labor at the plant depending on its design and method of operation. Added to this is the "compression charge" on the manufactured fuel, which may be readily calculated for the particular plant location and operating pressure.

Plant repairs are a negligible feature for the first five years or more, and then only nominal. Plant maintenance—painting, general upkeep, etc.—usually amounts to much more than the direct repairs.

To summarize the situation, it is possible to install gas plants of the foregoing types in towns of more than 2,000 population with reasonable investments, but to do so the situations must be thoroughly analyzed. Further, the gas service rendered is as satisfactory as, and to some who have used both, more satisfactory than the usual manufactured gas. With proper design and method of operation, operating costs are not excessive for such small gas deliveries.

■ ■

Butane Economical at Cajalco

(Continued from Page 60)

up with a terrific pace for 24 hours per day. Dirt was literally flying from the borrow pits to the top of the dyke.

Now, after one year of uninterrupted service (time out for rain) let us see what has been accomplished on the project. Cajalco Dyke is 80 per cent finished or 3,290,400 cubic yards are in place on the dyke. Cajalco Dam is 30 per cent finished or 1,023,000 cubic yards in place on the dam, a grand total of 4,313,400 cubic yards of pay dirt in place.

Five hundred thousand liquid gallons of butane have been consumed to move this amount of dirt. On this project a six-cent differential between the price of gasoline and that of butane was computed by the Griffith Co. Structure gasoline costs were 10 cents per gallon delivered (ex-tax). Butane costs were three and one half cents per gallon (ex-tax) with ½ cent per gallon allowed for delivery, making a total per-gallon cost of four cents.

The total price of all butane equipment, including 30 truck installations, two 7500-gallon storage tanks installed and one 2600-gallon transport truck, came to $15,000 net.

After simple analysis of the above figures, it must be clear that there has been a huge saving in fuel costs. Other savings have not been computed as yet but we do know from past experience that lubricating oil life, while using butane, is five times longer (no dilution) than it is while using any other motor fuel. Valve grinding is reduced to 80 per cent (no carbon formed) and total engine life is extended almost two to one, as compared to gasoline operated equipment.

Experts in dam construction state that the Cajalco project will be completed within an additional 10 or 12 months. At present, better than 100,000 cubic yards of dirt are being placed on the dyke per week. If the project is completed within 10 months the total elapsed time will be 27 months for the entire construction. The Griffith Co. contract calls for completion in three and one quarter years. Barring any unforseen major trouble, they will finish one whole year ahead of schedule.

This is truly an economy record, both for butane and for the Griffith Co.

AIR CONDITIONING
Electrogas
HEATING EQUIPMENT
FURNACES BLOWERS FILTERS WASHERS
Write for attractive Dealer proposition
ELECTROGAS FURNACE & MANUFACTURING CO.
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Advanced and proven design, precision manufacture and complete engineering service, insuring successful application and installation, are the salient features of N.G.E. Gas Burning Equipment. Your request for descriptive Bulletins will receive prompt attention.
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LOOK TO THE PIONEERS FOR CONTINUED LEADERSHIP

The Goodman Stopper
The Reliable Shut-off for Street Mains
Equipped with Improved Patented Locking Sleeve, which locks both handles to the pipe. Stopper cannot slip. Gas cannot pass.
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523 Atlantic Avenue, Brooklyn, N. Y.
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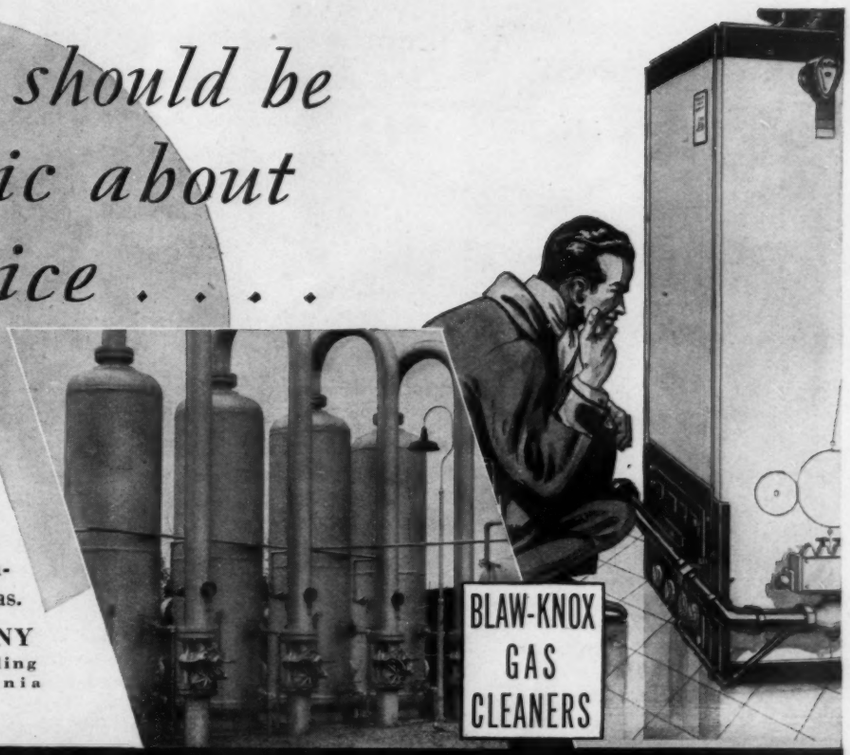
Consumers should be enthusiastic about Gas Service . . . .



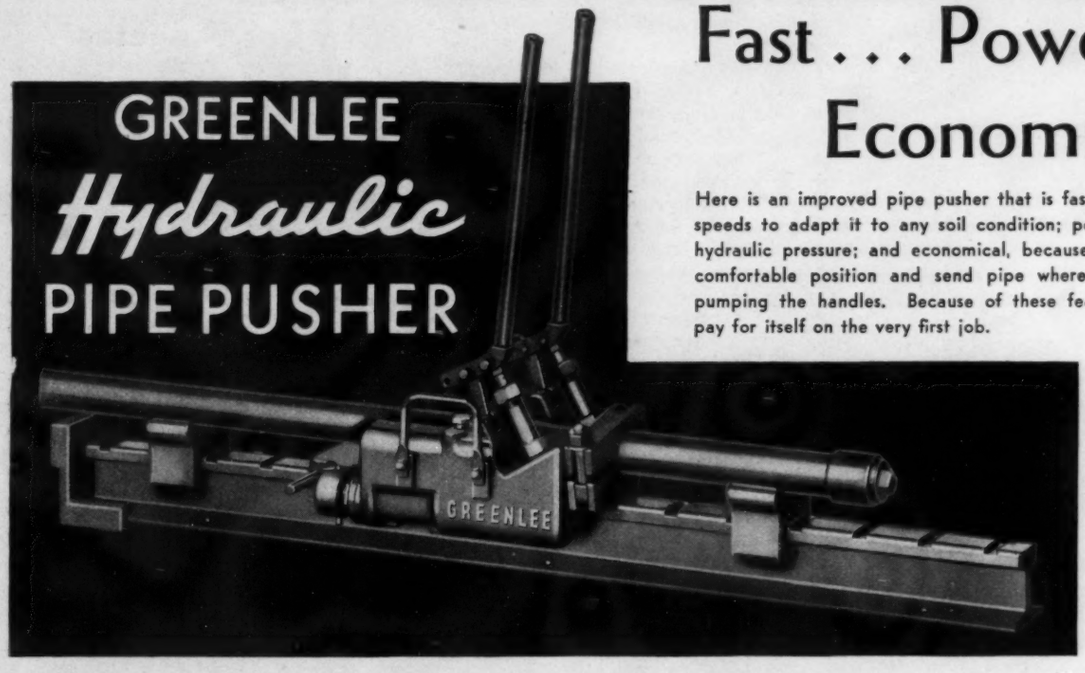
● Modern methods of gas heating require unfailing operation of automatic mechanism. A continuous supply of clean gas insures efficient gas heating and consumer satisfaction. Blaw-Knox Gas Cleaners remove all dust, dirt or abrasive materials from the gas.

BLAW-KNOX COMPANY
2033 Farmer's Bank Building
Pittsburgh, Pennsylvania

BLAW-KNOX GAS CLEANERS

BLAW-KNOX

GREENLEE *Hydraulic* PIPE PUSHER



Fast . . . Powerful . . . Economical

Here is an improved pipe pusher that is fast, because it has sufficient speeds to adapt it to any soil condition; powerful, because it utilizes hydraulic pressure; and economical, because one man can stand in a comfortable position and send pipe where it is wanted, simply by pumping the handles. Because of these features, it is often able to pay for itself on the very first job.

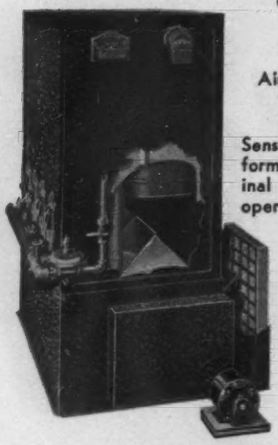
Write Now for Complete Details

The Greenlee Hydraulic Pusher is self-contained. It operates on a notched steel base, which permits making a push of from 4 to 7 feet, depending on the length of base used, without changing the pipe clamp. When it reaches the front end, it is pushed back and the quick-acting clamp is then reset. Pumping the handles sets up a pressure within two oil cylinders to push the pipe. This provides a smooth-acting, powerful mechanism. It will push pipe up to 4-inch and will exert a maximum pressure of 40,000 pounds on the pipe clamp.

GREENLEE TOOL CO., 1700 Columbia Ave., ROCKFORD, ILLINOIS

NEW LOW COST

FRASER



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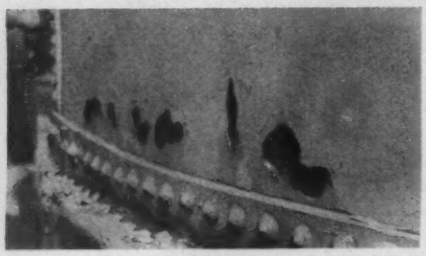

"Loss of Metal"

The photograph above shows what this means. Loss of capital investment due to rust, pitting and corrosion. NO-OX-ID is used widely in the gas industry to prevent just such losses in gas holders, accessory equipment and pipe and service lines. Stop your loss of metal.

Inquiries Invited.

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NO-OX-ID IRON-RUST TRADE MARK

The Original Rust Preventive

Improvements In Bottled Gas Appliances

(Continued from Page 90)

lating air fans and thermostatic control has been an important contribution to the effectiveness of these units as heating and ventilating equipment.

Marked improvements in the efficiency and other performance characteristics of bottled gas water heaters have likewise been made. The minimum "overall" or service efficiency requirement for automatic storage type heaters was increased in recent years over 10 per cent, while the minimum thermal efficiency for other type heaters was raised nearly 10 per cent. These increases, while numerically small, represent in general a considerable improvement in water heater design and construction, and, furthermore, will mean materially reduced gas bills to the consumer. The new types and sizes of water heaters recently developed have also been significant since it is now possible to supply, within practical limits, a heater specifically designed for exactly the kind of hot water service desired. This not only means economy but a service which cannot be contemporarily offered by any competitive fuel or energy, with the exception, of course, of city gases.

In looking toward the future there is every reason to believe that improvements in bottled gas appliance design will be even more rapid and valuable than they have been in the past. The large marketers give every evidence of continuing the good work already begun in research activities in their own laboratories and in encouraging appliance manufacturers to improve their products. The American Gas Association, through its Committee on Domestic Gas Research, has carried on for over a year, and is continuing at our Testing Laboratories a rather broad program in domestic appliance research. This project to date has included fundamental studies of gas range performance and recently a similar research investigation on water heaters was inaugurated. An important effect of such research activities by the American Gas Association and various large marketers of bottled gas has been to emphasize to the industry as a whole the absolute necessity and value of continued development and improvement. To those who have watched the situation closely, it has become evident that manufacturers not only mold into their products with commendable ingenuity the findings of fundamental research, but have shown increasing alertness and interest in experimentation and development on their own initiative. In fact, the whole gas industry seems imbued with an indomitable will to forge ahead and keep competition from other fuels on the defensive.

■ ■

Oil Co. Executive Dies

Robert M. Ketchum, manager of the purchasing department of the General Petroleum Corporation, died of heart disease in early March in Los Angeles, Calif. Mr. Ketchum joined General Petroleum in 1917 as a warehouse clerk. He soon became a buyer in the purchasing department, then assistant manager. In 1924 he was made manager.

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P. G. B. MORRISS
Manager

American Stove Introduces Closed Top Range

AMERICAN Stove Co., Cleveland, Ohio, introduces a closed top with an accurate, uniform heat distribution over the entire cooking top surface of a heavy duty gas range. The unit is now available for the food service industry.

Known as the "Uniform Heat Top" Magic Chef Heavy Duty range, it is available in a 32-inch wide unit with two rectangular cooking top plates, each 16 inches wide by 24 inches deep and in a 48-inch unit with three rectangular cooking plates. A top heat control is provided which controls temperatures by the simple setting of a dial.

Cooking plates are smooth and polished with an underside rib construction that insures uniform temperature over all sections.

Each separate cooking plate, however, on the same range can have a different temperature as the operator desires. Each plate has a specially designed dual burner.

Another advantage of the "Uniform Heat Top" is that the contents of two large kettles can be heated by using one cooking plate.

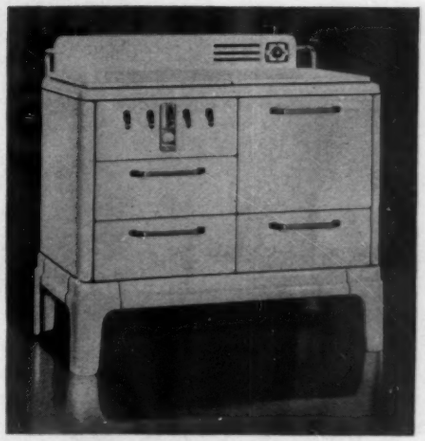
The top was designed for uniform broiling of large quantities of steaks, chops, etc. There are no small grease grooves on sides or back to clog. The sides and back have raised coved edges to prevent overflow of grease. Grease drains to a trough in front.

■ ■

W. H. Hill, American Radiator Co. Vice-president, Dies

William Hogarth Hill, 69 years of age, vice-president and director of American Radiator Co. and chairman of the board of The Fox Furnace Co., an affiliate of the former in the American Radiator and Standard Sanitary Corp., died January 29 from a heart attack, immediately after he arrived at his office in New York City.

Mr. Hill was one of the founders of American Radiator Co. when it was formed in 1892, and prior to that time was connected with the Michigan Radiator and Iron Co. of Detroit, one of the three firms from which American Radiator Co. was formed.



Geo. D. Roper Corp. Presents New Range Models

GEO. D. Roper Corp., Rockford, Ill., present a variety of new gas range models, including a 36-inch and a 38-inch table top model, and a deluxe extra-capacity range with pastry oven. All 1937 models have the new low-temperature oven burner, capable of maintaining temperatures of 250 degrees and lower, making possible shrinkage-saving low-temperature oven meat cookery and oven canning.

The Windsor model has three ovens—a roomy baking oven, a waist-high pastry oven with individual heat control, and a broiling oven with the smokeless rotating "Astrogril." The Commodore has one giant and three standard two-way center simmer burners.

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for the Sale of Automatic Gas Water Heaters

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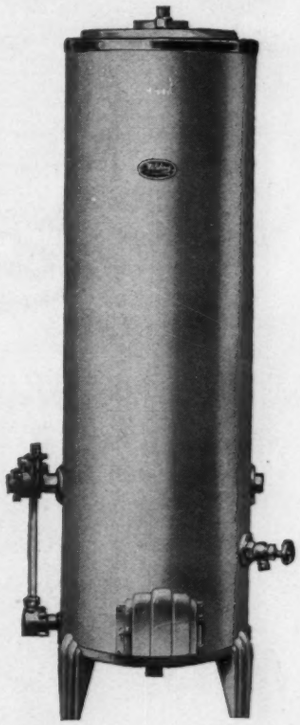

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Welsbach Automatic Storage Gas Water Heaters are scientifically designed to give perfect hot water service . . . Built by pioneers in the manufacture of gas burning appliances since 1887.

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MINNEAPOLIS HONEYWELL

Control Systems

Group attending Midwest Equitable Meter Co.'s second annual sales meeting.

Meter Co. Holds Annual Sales Meeting

THE second annual meeting of salesmen for the Midwest Equitable Meter Co.–Merco Nordstrom Valve Co. of Tulsa, was recently held at the company's Tulsa plant. These meetings were inaugurated by A. J. Kerr, district manager, last year to acquaint all men with new developments in the company's equipment, and its present products.

The sales territory for this district includes Oklahoma, Arkansas, Texas, Louisiana and New Mexico. Colonel W. F. Rockwell, of Pittsburgh, president of the parent companies, the Pittsburgh Equitable Meter Co. and Merco Nordstrom Valve Co., attended the meeting, as did the following salesmen:

M. D. Gilbert, C. K. Madison, E. P. Martin and C. R. Parker, Houston; F. A. Arnesen and W. R. McLaughlin, Dallas; W. J. McArt, Oklahoma City; O. W. Barnett, Shreveport; R. R. Bush, J. H. Baker, J. L. Cottrell and F. N. Dillman, Tulsa.

The meeting was held at the Tulsa plant where every type of equipment manufactured by the company is available for inspection and discussion. These products include Emco gas meters, Emco orifice meters, Emco gas regulators, water meters, oil and gasoline meters, Emco-McGaughy integrators and Nordstrom lubricated plug valves for use in every type of industry.

■ ■

Lycoming Co. Announces Gas Motor Generating Unit

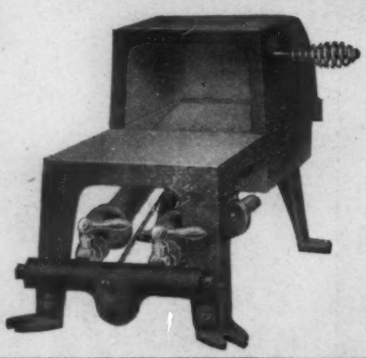
LYCOMING Manufacturing Co., Williamsport, Pa., has announced a gas motor automatic generating unit engineered for 100,000 hours of continuous duty that is of special interest to storekeepers, hotel owners and merchants.

The plant, automatic in operation, requires little attention and is easy to install, requiring only the connection of a gas pipe to the motor. Sizes range from 10 kw. to 60 kw., generating either alternate or direct current. For the smaller user of electric energy a single motor unit is available. For businesses that require 24-hour continuous service a dual-motor unit, composed of two motors and one generator, is offered.

The gas motor is quiet, clean, vibrationless, produces no smoke or odor, and does not heat up when running.

When used as a stationary motor to replace electric motors of from 10 to 50 hp. it operates at only a fraction of the cost of an electric motor.

JOHNSON NO. 502 BENCH FURNACE



This outstanding Bench Furnace is specially designed to heat soldering coppers up to 12 lbs. per pair. It can also be used for heat-treating work or metal melting. The patented curved shaped hood is hinged and can be easily removed. Equipped with two powerful Johnson Direct Jet Bunsen Burners, each with separate shut-off valve and pilot light. Efficient . . . . Durable . . . . Economical.

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JOHNSON GAS APPLIANCE CO. Cedar Rapids IOWA

Western Representative: C. B. Babcock Co. 135 Bluxome Street San Francisco, Calif.

Eastern Representative: J. H. McPherson 250 Stuart Street Boston, Mass.

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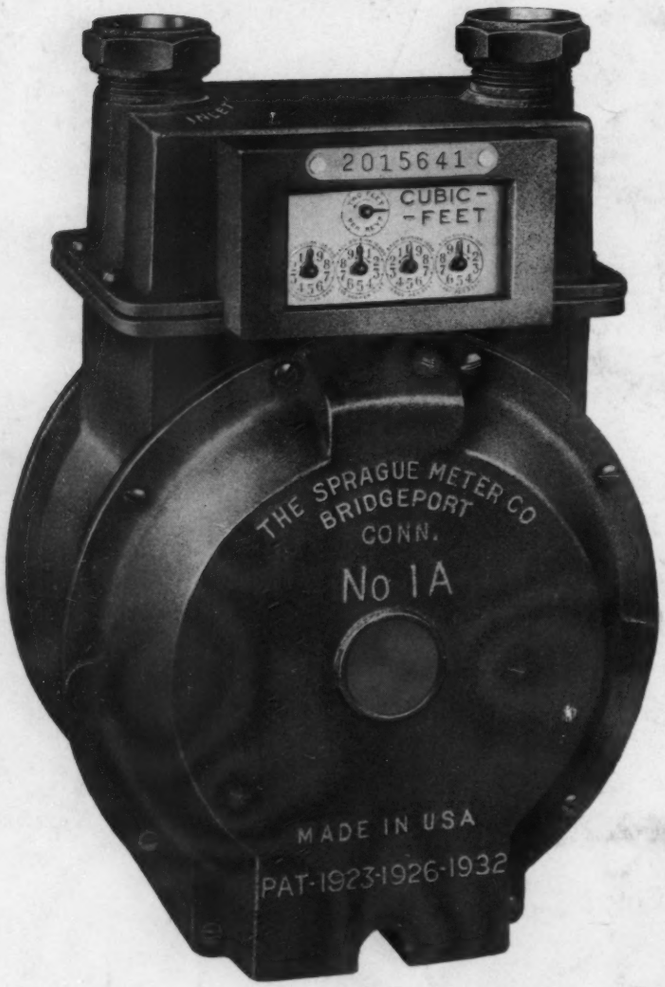

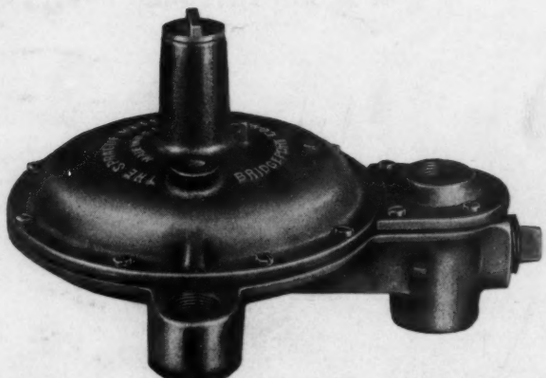

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